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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FINAL
FLIGHT MISSION RULES

APOLLO 14
(AS-509/110/LM-8)

NOVEMBER 1, 1970

PREPARED BY
FLIGHT CONTROL DIVISION

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

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INCLUDING APPROPRIATE CONTRACTORS

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APOLLO 14

FINAL FLIGHT MISSION RULES

PREFACE

THIS DOCUMENT CONTAINS THE FINAL FLIGHT MISSION RULES FOR APOLLO 14 AS OF NOVEMBER 1, 1970. ALL SUBSEQUENT REVISIONS TO THIS DOCUMENT WILL BE PRINTED ON DIFFERENT COLORED PAGES FOR EASY RECOGNITION.

IT IS REQUESTED THAT ANY ORGANIZATION HAVING COMMENTS, QUESTIONS, OR SUGGESTIONS CONCERNING THESE MISSION RULES CONTACT MR. JOHN H. TEMPLE, FLIGHT CONTROL OPERATIONS BRANCH, BUILDING 30, ROOM 2030 PHONE 483-3838.

ANY REQUESTS FOR ADDITIONAL COPIES OR CHANGES TO THE DISTRIBUTION LIST IN APPENDIX B OF THIS DOCUMENT MUST BE MADE IN WRITING TO MR. SIGURD A. SJOBERG, DIRECTOR OF FLIGHT OPERATIONS, MANNED SPACECRAFT CENTER, HOUSTON, TEXAS.

THIS IS A CONTROL DOCUMENT AND ANY CHANGES ARE SUBJECT TO THE CHANGE CONTROL PROCEDURES DELINEATED IN APPENDIX C. THIS DOCUMENT IS NOT TO BE REPRODUCED WITHOUT THE WRITTEN APPROVAL OF THE CHIEF, FLIGHT CONTROL DIVISION, MANNED SPACECRAFT CENTER, HOUSTON, TEXAS.

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' INTRODUCTION & PURPOSE '

MISSION RULES ARE PROCEDURAL STATEMENTS WHICH PROVIDE FLIGHT CONTROL PERSONNEL WITH GUIDELINES TO EXPEDITE THE DECISION-MAKING PROCESS. THE RULES ARE BASED ON AN ANALYSIS OF MISSION EQUIPMENT CONFIGURATION, SYSTEMS OPERATIONS AND CONSTRAINTS, FLIGHT CREW PROCEDURES, AND MISSION OBJECTIVES. THE DIRECTOR OF FLIGHT OPERATIONS, MANNED SPACECRAFT CENTER, HOUSTON, TEXAS, HAS THE OVERALL RESPONSIBILITY FOR THE PREPARATION, CONTENTS, AND CONTROL OF THE FLIGHT MISSION RULES.

MISSION RULES CAN BE CATEGORIZED AS GENERAL AND SPECIFIC. GENERAL MISSION RULES CONTAIN THE BASIC PHILOSOPHIES USED IN THE DEVELOPMENT OF THE FLIGHT MISSION RULES. SPECIFIC MISSION RULES PROVIDE THE BASIC CRITERIA FROM WHICH REAL-TIME DECISIONS ARE MADE AND WILL BE FORMATTED AS FOLLOWS---

A. THE CONDITION/MALFUNCTION COLUMN DEFINES THE FAILURE.

B. THE PHASE COLUMN IDENTIFIES THE TIME INTERVAL IN WHICH THE CONDITION/MALFUNCTION OCCURS.

C. THE RULING COLUMN DEFINES FLIGHT CONTROLLER ACTION AND/OR PROCEDURES THAT MUST BE ACCOMPLISHED AS A RESULT OF THE CONDITION.

D. THE CUES/NOTES/COMMENTS COLUMN PROVIDES THE FLIGHT CONTROLLER WITH ADDITIONAL INFORMATION CONCERNING THE CONDITION/MALFUNCTION AND/OR RULING.

R	ITEM	
		' OMSF GENERAL RULES '
	I-1	MISSION RULES ARE EFFECTIVE DURING THE LAUNCH COUNTDOWN, FLIGHT, RECOVERY, AND DURING PRELAUNCH TESTS WHEN APPLICABLE. WHEN POST MISSION QUARANTINE IS IMPOSED, RULES WILL BE APPLICALBE UNTIL DELIVERY OF THE FLIGHT CREW,FLIGHT HARDWARE,AND LUNAR SAMPLES TO THE LUNAR RECEIVING LABORATORY.
	I-2	DURING THE CONDUCT OF THE MISSION, THE MISSION DIRECTOR WILL BE ADVISED OF ALL RECOMMENDATIONS THAT INVOLVE CHANGES TO PRIMARY OBJECTIVES, MISSION RULES, FLIGHT PLAN CONTENT, OR LAUNCH/FLIGHT SAFETY.
	I-3	WITHIN THEIR RESPECTIVE AREAS OF RESPONSIBILITY, THE SPACECRAFT COMMANDER, THE LAUNCH DIRECTOR, FLIGHT DIRECTOR, DOD MANAGER FOR MSF SUPPORT OPERATIONS, AND THE MISSION DIRECTOR MAY TAKE OR RECOMMEND ANY ACTION REQUIRED FOR OPTIMUM CONDUCT OF THE MISSION.
	I-4	THE SPACECRAFT COMMANDER, SPACECRAFT TEST CONDUCTOR, LAUNCH VEHICLE TEST CONDUCTOR, SPACE VEHICLE TEST SUPERVISOR, LAUNCH OPERATIONS MANAGER, LAUNCH DIRECTOR, FLIGHT DIRECTOR, DOD MANAGER FOR MSF SUPPORT OPERATIONS, OR THE MISSION DIRECTOR MAY REQUEST A HOLD FOR CONDITIONS WITHIN THEIR RESPECTIVE AREAS OF RESPONSIBILITY.
	I-5	DURING THE COUNTDOWN, THE LAUNCH VEHICLE AND SPACECRAFT PROGRAM MANAGERS AND RESPECTIVE CENTER OPERATIONS MANAGERS WILL PROVIDE TECHNICAL ADVICE AND SUPPORT DIRECTLY TO THE LAUNCH OPERATIONS MANAGER AND LAUNCH DIRECTOR. THE LATTER TWO WILL KEEP THE MISSION DIRECTOR FULLY INFORMED OF PROBLEMS AND PROPOSED SOLUTIONS. DURING THE FLIGHT PHASE OF OPERATIONS, SIMILAR SUPPORT AS REQUIRED WILL BE PROVIDED TO THE FLIGHT DIRECTOR AND THE MSC DIRECTOR OF FLIGHT OPERATIONS. THE MISSION DIRECTOR WILL BE KEPT FULLY INFORMED BY THESE INDIVIDUALS OF PROBLEMS AND PROPOSED SOLUTIONS DURING THE APPLICABLE PHASES OF THE MISSION.
	I-6	WHEN TIME PERMITS, THE FAILURE OF A MANDATORY OR HIGHLY DESIRABLE ITEM WILL BE REPORTED TO THE MISSION DIRECTOR BY THE LAUNCH DIRECTOR OR THE FLIGHT DIRECTOR. THE INITIAL REPORT WILL INCLUDE THE POSITION OR FACILITY THAT DETECTED THE MALFUNTION. SUBSEQUENTLY, THE MISSION DIRECTOR WILL BE INFORMED OF ESTIMATED TIME TO REPAIR AND RECOMMENDED PROCEED, HOLD, RECYCLE, OR SCRUB ACTION AS IT DEVELOPS.

R	ITEM	
	I-7	IF A MANDATORY ITEM FAILS DURING THE COUNTDOWN, IT WILL BE CORRECTED PRIOR TO LAUNCH, HOLDING OR RECYCLING THE COUNTDOWN AS NECESSARY. IF A MADATORY ITEM CANNOT BE CORRECTED TO PERMIT LIFTOFF WITHIN THE LAUNCH WINDOW, THE MISSION DIRECTOR MAY PROCEED WITH THE LAUNCH AFTER APPROPRIATE COORDINATION WITH THE APPROPRIATE OPERATIONS AND PROGRAM MANAGERS. GENERALLY THE LOSS OF A MANDATORY ITEM WILL RESULT IN A SCRUB.
	I-8	AS THE DESIGNATED REPRESENTATIVE OF THE PROGRAM DIRECTOR, ONLY THE MISSION DIRECTOR MAY SCRUB THE MISSION. FURTHER, THE MISSION DIRECTOR RETAINS THE PRIMARY AUTHORITY TO DOWNGRADE A MANDATORY CATEGORY. THIS AUTHORITY WILL BE EXERCISED AS CIRCUMSTANCES DICTATE AND AFTER APPROPRIATE RECOMMENDATIONS FROM THE DIRECTOR OF FLIGHT OPERATIONS, PROGRAM MANAGERS, LAUNCH DIRECTOR, AND FLIGHT DIRECTOR.
	I-9	CONSIDERATION WILL BE GIVEN TO THE REPAIR OF ANY HIGHLY DESIRABLE ITEM, BUT IN NO CASE WILL THE LAUNCH BE SCRUBBED FOR ANY SINGLE HIGHLY DESIRABLE ITEM. IF TWO OR MORE HIGHLY DESIRABLE ITEMS FAIL AND/OR OTHER AGRAVATING CIRCUMSTANCES OCCUR, THE MISSION DIRECTOR MAY SCRUB THE MISSION AFTER COORDINATION WITH THE APPROPRIATE OPERATIONS AND PROGRAM MANAGERS.
	I-10	WHENEVER POSSIBLE, THE LAUNCH SITE AND MCC WILL VERIFY TELEMETRY READOUT DISCREPANCIES OCCURRING PRIOR TO LIFTOFF. IF THE MCC LOSES A PARAMETER BUT THE LAUNCH SITE HAS A VALID READOUT, THE MCC WILL CONTINUE ON THE LAUNCH SITE READOUT. THIS IS TRUE EXCEPT FOR THOSE MANDATORY PARAMETERS (LISTED IN THE FLIGHT MISSION RULES) UPON WHICH MISSION RULES ACTION IS TAKEN. IN THIS CASE, A HOLD MAY BE CALLED TO EVALUATE THE PROBLEM.
	I-11	THE COUNTDOWN WILL CONTINUE WHERE POSSIBLE CONCURRENTLY WITH CORRECTION OF AN EXISTING PROBLEM.
	I-12	THE LAUNCH DIRECTOR WILL BE RESPONSIBLE FOR ALL ACTIONS IN THE EVENT OF LAUNCH SITE EMERGENCIES,EXCEPT FOR RECOVERY OPERATIONS OF THE FLIGHT CREW AND SPACECRAFT RESULTING FROM A PAD ABORT.
	I-13	THE LAUNCH OPERATIONS MANAGER MAY SEND AN ABORT REQUEST FROM THE TIME THE LAUNCH ESCAPE SYSTEM IS ARMED UNTIL THE SPACE VEHICLE REACHES SUFFICIENT ALTITUDE TO CLEAN THE TOP OF THE UMBILICAL TOWER. THE CRITERIA FOR SENDING AN ABORT REQUEST WILL BE ESTABLISHED IN THE LAUNCH MISSION RULES.

R	ITEM	
	I-14	FROM LIFTOFF TO UMBILICAL TOWER CLEARANCE, THE LAUNCH DIRECTOR AND FLIGHT DIRECTOR WILL HAVE CONCURRENT RESPONSIBILITY FOR SENDING AN ABORT REQUEST. THE CRITERIA FOR SENDING AN ABORT REQUEST DURING THIS PERIOD WILL BE ESTABLISHED IN THE LAUNCH AND FLIGHT MISSION RULES RESPECTIVELY.
	I-15	WHERE POSSIBLE ALL MANUAL ABORT COMMAND/REQUESTS FROM THE GROUND DURING FLIGHT WILL BE BASED ON TWO INDEPENDENT INDICATIONS OF THE FAILURE. CREW ABORT ACTION WILL NORMALLY BE BASED UPON TWO CUES.
	I-16	THE LAUNCH OPERATIONS MANAGER WILL INFORM THE MCC WHEN THE SPACE VEHICLE REACHES SUFFICIENT ALTITUDE TO CLEAN THE TOP OF THE UMBILICAL TOWER BY STATING 'CLEAR TOWER' OVER ONE OF THE LOOPS FOR KSC TO MCC.
	I-17	IN THE EVENT OF NON-CATASTROPHIC SPACE VEHICLE COLLISION WITH THE UMBILICAL TOWER OR OTHER CONTINGENCIES WHICH DO NOT REQUIRE IMMEDIATE ACTION, THE LAUNCH OPERATIONS MANAGER WILL CONTINUE TO EVALUATE THE EXTENT OF DAMAGE AND WILL PROVIDE INFORMATION TO THE FLIGHT DIRECTOR FOR ANY ACTION NECESSARY AFTER UMBILICAL TOWER CLEARANCE.
	I-18	COMPLETE GROUND CONTROL OF THE SPACE VEHICLE PASSES FROM THE LAUNCH DIRECTOR TO THE FLIGHT DIRECTOR WHEN THE SPACE VEHICLE REACHES SUFFICIENT ALTITUDE TO CLEAR THE TOP OF THE UMBILICAL TOWER.
	I-19	IN THE MCC, THE FLIGHT DIRECTOR, FLIGHT DYNAMICS OFFICER AND BOOSTER SYSTEMS ENGINEER WILL HAVE THE CAPABILITY TO SEND AN ABORT REQUEST. THE CRITERIA FOR SENDING AN ABORT REQUEST WILL BE ESTABLISHED IN THE FLIGHT RULES.
	I-20	THE SPACECRAFT COMMANDER MAY INITIATE SUCH INFLIGHT ACTION AS HE DEEMS ESSENTIAL FOR CREW SAFETY.
	I-21	FLIGHT CREW SAFETY SHALL TAKE PRECEDENCE OVER THE ACCOMPLISHMENT OF MISSION OBJECTIVES.
	I-22	IN THE EVENT OF COMMUNICATIONS LOSS BETWEEN THE MANNED SPACE FLIGHT NETWORK AND THE SPACECRAFT, THE SPACECRAFT COMMANDER WILL ASSUME RESPONSIBILITY FOR MISSION CONDUCT AS DESCRIBED WITHIN THE FLIGHT MISSION RULES.
	I-23	THE FLIGHT DIRECTOR, THROUGH THE RECOVERY COORDINATOR, WILL PROVIDE THE DOD MANAGER FOR MANNED SPACE FLIGHT SUPPORT OPERATIONS THE PREDICTED LOCATION AND TIME OF SPLASHDOWN.

R	ITEM	
	I-24	THE DOD MANAGER FOR MANNED SPACEFLIGHT SUPPORT OPERATIONS IS RESPONSIBLE FOR RECOVERY, AND FOR COMMAND AND CONTROL OF DOD RECOVERY FORCES. RECOMMENDATIONS, GUIDELINES AND REQUIREMENTS, AS SET FORTH BY NASA, WILL BE CONSIDERED TO EFFECT SAFE AND EXPEDITIOUS RECOVERY OF THE FLIGHT CREW AND SPACECRAFT.
	I-25	IF THE LM DESCENT STAGE WITH A NUCLEAR POWER SOURCE ABOARD IS ABANDONED WHILE SUBJECT TO EARTH RETURN, AND CREW SAFETY AND CONTROL SYSTEMS CONSIDERATIONS PERMIT, THE LM WILL BE TARGETED FOR AN OCEAN AREA REENTRY. THE PREDICTED IMPACT LOCATION WILL BE DETERMINED AND REPORTED TO THE APOLLO MISSION DIRECTOR.
	I-26	NO SPACE VEHICLE COMPONENT WILL BE DELIBERATELY TARGETED FOR A LUNAR IMPACT WITHOUT THE PRIOR APPROVAL OF THE APOLLO MISSION DIRECTOR.
		RULE NUMBERS I-27 THROUGH I-35 ARE RESERVED.

R	ITEM	
		' DEFINITIONS '
	I-36	PRIMARY OBJECTIVE--- A STATEMENT OF THE PRIMARY PURPOSE OF THE FLIGHT. WHEN USED IN CENTER CONTROL DOCUMENTATION THE PRIMARY OBJECTIVE(S) MAY NOT BE MODIFIED, BUT MAY BE AMPLIFIED BY DETAILED OBJECTIVES.
	I-37	DETAILED OBJECTIVE--- A SCIENTIFIC, ENGINEERING, MEDICAL OR OPERATIONAL INVESTIGATION THAT PROVIDES IMPORTANT DATA AND EXPERIENCE FOR USE IN DEVELOPMENT OF HARDWARE AND/OR PROCEDURES FOR APPLICATION TO APOLLO MISSIONS. CSM ORBITAL PHOTOGRAPHIC TASKS, THOUGH REVIEWED BY THE MANNED SPACE FLIGHT EXPERIMENTS BOARD, ARE NOT ASSIGNED AS FORMAL EXPERIMENTS AND WILL BE PROCESSED AS A SINGLE DETAILED OBJECTIVE.
	I-38	CATEGORY---A CATEGORY IS A DEGREE OF IMPORTANCE ASSIGNED TO SPACE VEHICLE AND OPERATIONAL SUPPORT ELEMENTS. SPECIFIC CATEGORIES APPLICABLE TO MISSION RULES ARE MANDATORY AND HIGHLY DESIRABLE.
	I-39	MANDATORY (M)--- A MANDATOR ITEM IS A SPACE VEHICLE ELEMENT OR OPERATIONAL SUPPORT ELEMENT THAT IS ESSENTIAL FOR ACCOMPLISHMENT OF THE MISSION, WHICH INCLUDES PRELAUNCH, FLIGHT, AND RECOVERY OPERATIONS THAT ENSURE CREW SAFETY AND EFFECTIVE OPERATIONAL CONTROL AS WELL AS THE ATTAINMENT OF THE PRIMARY OBJECTIVES.
	I-40	HIGHLY DESIRABLE (HD)---A HIGHLY DESIRABLE ITEM IS A SPACE VEHICLE ELEMENT OR OPERATIONAL SUPPORT ELEMENT THAT SUPPORTS AND ENHANCES THE ACCOMPLISHMENT OF THE MISSION AND IS ESSENTIAL FOR THE ACCOMPLISHMENT OF THE DETAILED OBJECTIVES.
	I-41	SPACE VEHICLE ELEMENT---A PART OF ANY LAUNCH VEHICLE OR SPACECRAFT SYSTEM.
	I-42	OPERATIONAL SUPPORT ELEMENT--- A PART OF ANY SYSTEM OR ACTIVITY THAT IS INVOLVED IN THE COUNTDOWN, LAUNCH, FLIGHT, OR RECOVERY OPERATIONS, OTHER THAN THOSE ELEMENTS WHICH ARE A PART OF THE SPACE VEHICLE ITSELF.
	I-43	REDLINE---A REDLINE VALUE IS A MAXIMUM AND/OR MINIMUM LIMIT OF A CRITICAL PARAMETER NECESSARY TO IDENTIFY VEHICLE, SYSTEM, AND COMPONENT PERFORMANCE AND OPERATION. REDLINE VALUES WILL BE ESTABLISHED SUCH THAT FURTHER DEGRADATIONS OF THE SYSTEM OR COMPONENT COULD LEAD TO A FAILURE TO ACCOMPLISH THE PRIMARY OBJECTIVES.
	I-44	REDLINE FUNCTION---A REDLINE FUNCTION IS A PARAMETER THAT HAS BEEN IDENTIFIED TO MONITOR THE FUNCTIONING OF A UNIT TO ENSURE THE OPERATIONAL PERFORMANCE OF THAT UNIT IS ACCEPTABLE TO MEET THE PRIMARY OBJECTIVES. REDLINE FUNCTIONS ARE MANDATORY.
	I-45	MEASUREMENT---A MEASUREMENT IS A SPECIFIC DATA CHANNEL OF INSTRUMENTATION MONITORING A SINGLE FUNCTION.
	I-46	INSTRUMENTATION---INSTRUMENTATION IS THE EQUIPMENT THAT ACQUIRES, TRANSMITS AND MONITORS DATA FOR PERFORMANCE EVALUATION OF SPACE VEHICLE AND OPERATIONAL SUPPORT ITEMS.

R	ITEM	
	I-47	COUNTDOWN--- THE PERIOD OF TIME COMMENCING WITH START OF THE OFFICIAL COUNTDOWN CLOCK. DURING THE INTERVAL OF TIME PRIOR TO THIS PERIOD, TASK ACCOMPLISHMENT IS NOT STRICTLY TIME RELATED AND A HOLD IS A MEANINGLESS TERM. THE OFFICIAL COUNTDOWN CLOCK STARTS AT THE BEGINNING OF LAUNCH VEHICLE BATTERY INSTALLATION.
	I-48	PROCEED---CONTINUE IN ACCORDANCE WITH PRESCRIBED COUNTDOWN PROCEDURES.
	I-49	HOLD--- INTERRUPTION OR DELAY OF THE COUNTDOWN FOR ANY REASON, SUCH AS UNFAVORABLE WEATHER, REPAIR OF HARDWARE, OR CORRECTION OF CONDITIONS UNSATISFACTORY FOR LAUNCH OR FLIGHT.
	I-50	HOLD-POINT---A PREDETERMINED POINT WHERE THE COUNTDOWN MAY BE CONVENIENTLY INTERRUPTED.
	I-51	SCRUB---THE LAUNCH IS TERMINATED TO BE RESCHEDULED.
	I-52	RECYCLE---THE COUNTDOWN IS STOPPED AND RETURNED TO A DESIGNATED POINT OR AS SPECIFIED IN THE LAUNCH MISSION RULES.
	I-53	TURNAROUND TIME---TURNAROUND TIME IS THE TOTAL TIME REQUIRED FROM A SCRUB TO THE NEXT SCHEDULED LIFTOFF TIME (T-0) INCLUDING RECYLCE AND COUNTDOWN.
	I-54	CUTOFF---THE AUTOMATIC OR MANUAL COMMAND TO STOP THE LAUNCH SEQUENCE AFTER INITIATION OF THE ''AUTOMATIC LAUNCH SEQUENCE''.
	I-55	LIFTOFF---THE EVENT DETERMINED BY THE INSTRUMENTATION UNIT UMBILICAL DISCONNECT SIGNAL AND IS THE POINT IN TIME WHEN PLUS TIME COMMENCES.
	I-56	ABORT---MISSION TERMINATION BY UNSCHEDULED INTENTIONAL SEPARATION OF THE SPACECRAFT FROM THE LAUNCH VEHICLE PRIOR TO ORBITAL INSERTION.
	I-57	EARLY MISSION TERMINATION--- UNSCHEDULED INTENTIONAL MISSION TERMINATION AT OR AFTER ORBITAL INSERTION.
	I-58	MISSION PERIOD TERMINATION (LUNAR LANDING MISSION)--- MISSION PERIOD TERMINATION OCCURS UPON THE RELEASE OF THE FLIGHT CREW, FLIGHT HARDWARE, OR RELEASE OF THE LUNAR SAMPLES TO APPROVED PRINCIPLE INVESTIGATORS, WHICH EVER OCCURS LATER.

R	ITEM	
		GENERAL
	1-1	THE FLIGHT MISSION RULES OUTLINE PREPLANNED DECISIONS DESIGNED TO MINIMIZE THE AMOUNT OF REAL-TIME RATIONALIZATION REQUIRED WHEN NON-NOMINAL SITUATIONS OCCUR DURING THE TERMINAL COUNTDOWN, THE FLIGHT PHASE, AND RECOVERY OPERATIONS.
	1-2	WHENEVER POSSIBLE, THE CREW AND GROUND WILL VERIFY ALL MALFUNCTIONS. WHENEVER THERE IS A CONFLICT BETWEEN SPACECRAFT AND GROUND TELEMETRY READOUTS, THE SPACECRAFT READOUTS ARE PRIME (ASSUMING THE SPACECRAFT HAS ADEQUATE INSTRUMENTATION AND THAT APPLICABLE SPACECRAFT COCKPIT READOUTS ARE OPERATIONAL).
	1-3	SPACECRAFT LAUNCH WILL NOT BE ATTEMPTED IF KNOWN SPACECRAFT SYSTEMS MALFUNCTIONS WILL LIMIT THE MISSION DURATION SUCH THAT ACCOMPLISHMENT OF THE PRINCIPAL DETAILED OBJECTIVES WILL BE COMPROMISED.
	1-4	WHEN A CONFLICT OF FLIGHT PLAN ACTIVITIES OCCURS, THE FLIGHT DIRECTOR WILL DETERMINE THE PRIORITY OF ACTIVITIES.
	1-5	IN SOME INSTANCES, THE SPECIFIC MISSION RULES MAY DEVIATE FROM THE GENERAL GUIDELINES CONTAINED IN PART I OR FROM THESE GENERAL RULES. THE SPECIFIC MISSION RULE WILL APPLY IN ALL CASES, AND THE DEVIATIONS FROM THE GENERAL GUIDELINES WILL BE NOTED.
	1-6	THE FLIGHT DIRECTOR MAY, AFTER ANALYSIS OF THE FLIGHT, CHOOSE TO TAKE ANY NECESSARY ACTION REQUIRED FOR THE SUCCESSFUL COMPLETION OF THE MISSION.
	1-7	MISSION RULE LIMITS THAT ARE CONSIDERED TO BE INTERIM OR UNCONFIRMED NUMBERS WILL BE UNDERLINED IN THIS PUBLICATION AND ALL SUBSEQUENT REVISIONS UNTIL THE NUMBERS ARE CONFIRMED BY THE RESPONSIBLE NASA AGENCY.
	1-8	THE SYSTEMS LIMITS LISTED IN THESE RULES ARE THE ACTUAL VEHICLE LIMITS AS WELL AS THEY ARE KNOWN AND UNDERSTOOD AND ARE NOT BIASED TO COMPENSATE FOR TIME DELAYS OR INSTRUMENTATION ERRORS WITHIN THE SPACECRAFT AND MSFN DATA/DISPLAY SYSTEMS.
	1-9	UNLESS STATED OTHERWISE, MANDATORY AND HIGHLY DESIRABLE INSTRUMENTATION REQUIREMENTS ARE SATISFIED BY EITHER ONBOARD OR PCM CAPABILITY.

R	ITEM	
	1-10	MANDATORY SPACE VEHICLE INSTRUMENTATION FOR THE PURPOSES OF FLIGHT MISSION RULES MUST BE IN CONSONANCE WITH THE FOLLOWING CRITERIA--- (REFERENCE OMSF GENERAL RULE I-42). A. REQUIRED TO INSURE FLIGHT CREW SAFETY. B. REQUIRED TO IMPLEMENT RULES RESULTING IN LAUNCH ABORTS. C. REQUIRED TO IMPLEMENT RULES RESULTING IN EARLY MISSION TERMINATION. D. REQUIRED TO MAKE DECISION TO CONTINUE TO THE NEXT MISSION PHASE. THE MANDATORY INSTRUMENTATION LISTINGS IN THIS DOCUMENT WILL BE CROSS-REFERENCED TO THE APPROPRIATE MISSION RULE MEETING THE ABOVE CRITERIA.
	1-11	THE CRITERION FOR CATEGORIZING INSTRUMENTATION AS HIGHLY DESIRABLE IN THE FLIGHT MISSION RULES IS ANY INSTRUMENTATION REQUIRED FOR NORMAL SYSTEMS MANAGEMENT OR REQUIRED FOR FLIGHT CONTROL DECISIONS NOT IN THE MANDATORY CATEGORY.
	1-12	RF COMMANDS WILL NOT BE TRANSMITTED TO THE SPACECRAFT OR LAUNCH VEHICLE DURING THE LAUNCH PHASE UNLESS SPECIFIC MISSION RULES ARE INVOKED WHICH REQUIRE COMMAND ACTIVITY.
	1-13	THE LAUNCH OPERATIONS MANAGER WILL INFORM THE FLIGHT DIRECTOR WHEN THE SPACE VEHICLE HAS CLEARED THE UMBILICAL TOWER BY STATING ''CLEAR TOWER'' OVER CHANNEL 111.
	1-14	THE COMMAND PILOT MAY INITIATE SUCH INFLIGHT ACTION AS HE DEEMS ESSENTIAL FOR CREW SAFETY.
	1-15	IN THE EVENT OF LOSS OF COMMUNICATIONS BETWEEN THE MSFN AND THE S/C, THE COMMAND PILOT WILL ASSUME RESPONSIBILITY OF MISSION DIRECTION WITHIN THE FRAME WORK OF THE MISSION RULES.
		RULE NUMBERS 1-16 THROUGH 1-23 ARE RESERVED.

R	ITEM	
		' DEFINITIONS '
	1-24	ASAP---AS SOON AS PRACTICABLE (I.E., AS SOON AS POSSIBLE AND REASONABLE).
	1-25	PTP---A PREFERRED TARGET POINT IS A STRATEGICALLY LOCATED SET OF COORDINATES FOR WHICH THE SPACECRAFT SHOULD BE TARGETED IF IT BECOMES NECESSARY TO LAND ON THAT REVOLUTION.
	1-26	ATP--- AN ''ALTERNATE TARGET POINT'' IS A STRATEGICALLY LOCATED SET OF COORDINATES CHOSEN TO PROVIDE A SPACECRAFT TARGET POINT MIDWAY BETWEEN PTP'S.
	1-27	NEXT BEST PTP---A PREFERRED TARGET POINT WHICH CAN BE REACHED BY THE SPACECRAFT WITHIN THE CONSTRAINTS IMPOSED BY THE SPACECRAFT PROBLEM CAUSING AN EARLY MISSION TERMINATION AND ALLOWING THE BEST POSSIBLE REENTRY AND LANDING AREA CONDITIONS. THE MISSION WILL NOT PROCEED TO THE NEXT PHASE UNLESS SPECIFICALLY NOTED.
	1-28	REENTER ASAP---REENTER AS SOON AS PRACTICABLE (I.E., AS SOON AS POSSIBLE AND REASONABLE).
	1-29	TERMINATE ASAP---REENTER WITH THE MINIMUM TRIP TIME TO AN UNSPECIFIED LANDING AREA.
	1-30	CRITICAL MANEUVERS--- (A) ANY BURN REQUIRED TO EFFECT CREW RECOVERY WHEN THERE IS NO ALTERNATIVE METHOD FOR OBTAINING THE NECESSARY DELTA V OR (B) ANY REQUIRED BURN WHERE THE USE OF A DEGRADED SPS IS PREFERABLE TO THE USE OF ANY AVAILABLE ALTERNATIVE METHOD. THE MANEUVERS TABULATED ON M. R. 3-86 HAVING SPS LIMITS OF ''NONE'' OR ''LOOSE'' ARE GENERALLY CATEGORIZED AS CRITICAL BURNS WITH THE DEGREE OF CRITICALITY INDICATED BY THE ENGINE LIMITS AND CREW ACTIONS SPECIFIED IN THAT TABLE.
	1-31	NON-CRITICAL BURN--- A NON-CRITICAL BURN IS ANY OTHER BURN AND INCLUDES THOSE CHARACTERIZED BY ''TIGHT'' LIMITS IN M. R. 3-86. BECAUSE OF TRAJECTORY CONSIDERATIONS OR OTHER REASONS A NON-CRITICAL BURN MAY, ONCE INITIATED, CHANGE CLASSIFICATION. ALSO SOME BURNS CONSIDERED AS NON-CRITICAL MAY BE RECLASSIFIED IF, IN THE EXISTING MISSION SITUATION, THE FLIGHT DIRECTOR JUDGES IT'S VALUE TO BE COMENSURATE WITH ANY INCREASED RISK.
	1-32	EARLY STAGING---UNSCHEDULED SEPARATION OF THE S-IVB STAGE FROM THE S-II STAGE.

R	ITEM	
	1-33	CONTINGENCY ORBIT INSERTION (COI)--- AN SPS PROPULSIVE MANEUVER WHICH WILL PROVIDE CSM INSERTION INTO A SAFE ORBIT (HP GREATER THAN OR EQUAL TO 75 NM) IN THE EVENT OF AN SLV FAILURE OCCURRING IMMEDIATELY PRIOR TO INSERTION, OR IN THE EVENT OF DEGRADED SLV PERFORMANCE.
	1-34	S-IVB DESTRUCT PACKAGE SAFING---THE EMERGENCY DESTRUCT PACKAGE IS SAFED BY THE RSO TRANSMITTING A COMMAND WHICH PERMANENTLY REMOVES POWER FROM THE RANGE SAFETY RECEIVERS.
	1-35	S-IVB SAFING---A PASSIVATION SEQUENCE IN WHICH S-IVB LOX, LH2, AND HIGH PRESSURE SPHERES ARE DEPLETED.
	1-36	PRELAUNCH PHASE (PRELN)---THE TIME INTERVAL FROM THE COMPLETION OF THE FLIGHT READINESS REVIEW TO LIFTOFF.
	1-37	FLIGHT PHASE---THE INTERVAL FROM LIFTOFF THROUGH SPLASHDOWN. FOR MISSION RULE PURPOSES THE FLIGHT PHASE IS FURTHER SUBDIVIDED AS SHOWN BELOW--- A. LAUNCH PHASE---FROM LIFTOFF THROUGH INSERTION (TB1 THROUTH TB4). B. EARTH ORBIT PHASE---FROM INSERTION THROUGH S-IVB CUTOFF FOR TRANSLUNAR INJECTION (TLI). C. TD&E PHASE---FROM CSM/S-IVB SEPARATION THROUGH LM EJECTION FROM SLA. D. TRANSLUNAR COAST PHASE---FROM S-IVB CUTOFF FOR TLI THROUGH LOI1 CUTOFF. E. DOCKED PHASE---THE TIME INTERVALS DURING WHICH THE LM AND CSM ARE DOCKED. F. LUNAR ORBIT PHASE---FROM LOI CUTOFF TO UNDOCKING AND FROM REDOCKING TO TEI CUTOFF. G. UNDOCKED PHASE---FROM UNDOCKING TO CSM CIRCULARIZATION. H. PRE-PDI PHASE---FROM CIRCULARIZATION TO PDI. I. POWERED DESCENT---THE TIME INTERVAL FROM THE INITIATION OF THE PDI MANEUVER TO TOUCHDOWN. 1. PDI TO PDI + 5+30 - DURING THIS TIME PERIOD THE LM CAN ABORT THE POWERED DESCENT AND GET INTO ORBIT USING THE DPS ONLY AND RETAIN THE DESCENT STAGE AFTER INSERTION. 2. PDI + 5+30 TO HIGH GATE - THIS PERIOD ENDS WHEN THE MANEUVER IS MADE TO VISUALLY AQUIRE THE LANDING SITE. 3. HIGH GATE TO LO GATE---LO GATE IS THE POINT AT WHICH THE CREW TAKES OVER AND MANUALLY FLIES THE DESCENT. 4. LO GATE TO TOUCHDOWN---THE TIME INTERVAL FROM CREW TAKEOVER (APPROXIMATELY 500 FT ALTITUDE) TO LANDING. J. LUNAR STAY PHASE---THE TIME INTERVAL FROM TOUCHDOWN UNTIL LIFTOFF. EVA---THE TIME INTERVAL FROM LM DEPRESSURIZATION UNTIL LM REPRESSURIZATION. K. ASCENT PHASE---THE TIME INTERVAL FROM LIFTOFF TO LM INSERTION INTO LUNAR ORBIT. L. RENDEZVOUS---THE TIME INTERVAL FROM INSERTION INTO LUNAR ORBIT AFTER ASCENT OR AFTER AN ABORTED DESCENT UNTIL CSM/LM DOCKING. M. TRANSEARTH COAST PHASE---FROM TEI CUTOFF TO CM/SM SEPARATION. N. ENTRY PHASE---FROM CM/SM SEPARATION TO SPLASHDOWN.

R	ITEM	
	1-38	RECOVERY PHASE---THE TIME INTERVAL FROM SPLASHDOWN TO DELIVERY OF THE FLIGHT CREW AND SPACECRAFT TO DESIGNATED LAND BASED INSTALLATIONS.
	1-39	REENTRY DEFINITIONS--- A. AUTOMATIC---REENTRY CONTROLLED BY CMC WHICH OUTPUTS BANK ANGLE COMMAND TO THE RCS. B. CLOSED LOOP---REENTRY CONTROLLED BY THE CREW MANUALLY FLYING BANK ANGLE MODULATION USING CMC ENTRY PROGRAM OUTPUTS. C. OPEN LOOP REENTRY---REENTRY CONTROLLED BY THE CREW USING SPACECRAFT DISPLAYS AND FLYING--- 1. BANK ANGLE (RR 0-90) AND RETRB (RL 0-90). 2. CONSTANT BANK ANGLE---CREW ESTABLISHES AND MAINTAINS A CONSTANT BANK ANGLE. (CONSTANT BANK ANGLES GREATER THAN 90 DEGREES WILL NOT BE FLOWN EXCEPT WHEN SKIPOUT RULE IS VIOLATED.) 3. ROLLING REENTRY---MAINTAIN CONSTANT 18 DEGREES PER SECOND ROLL RATE. 4. EMS RANGING---CONSTANT BANK ANGLE IS HELD TO 1G, THEN THE RANGE TO GO DISPLAY AND THE RANGE POTENTIAL LINES ARE COMPARED TO MODULATE THE BANK ANGLE. AT RETRB THE PRESENT BANK ANGLE IS REVERSED. D. CONSTANT G ENTRY---CREW CONTROLS THE BANK ANGLE TO MAINTAIN A SPECIFIED G LEVEL. E. EMS REENTRY---CREW CONTROLS THE BANK ANGLE TO MAINTAIN A CONSTANT G UNTIL VELOCITY LESS THAN 25,500 FPS. THE EMS IS THEN USED TO CONTROL RANGE BY NULLING THE DIFFERENCE BETWEEN THE RANGE TO GO COUNTER AND THE RANGE POTENTIAL GUIDELINES. ALL MANEUVERS ARE OVERRIDDEN AS NECESSARY TO PREVENT AN ONSET OR OFFSET VIOLATION.
	1-40	OPERATIONAL FOOTPRINT--THE AREA THAT IS OPERATIONALLY ACCESSIBLE USING THE G+N,EMS,AND CONSTANT 4G ENTRY MODES AND ALLOWING FOR THEIR ASSOCIATED DISPERSIONS. THE G+N PORTION IS AN AREA +/-70 NM TO EITHER SIDE OF THE GROUND TRACK AND EXTENDING FROM 915 NM FROM EI TO 2000 NM FROM EI. THE EMS AREA IS THE AREA FROM 61 NM UPRANGE TO 91 NM DOWNRANGE AND +/-52 NM IN CROSSRANGE ABOUT THE CONSTANT 4G TARGET POINTS. THE CONSTANT 4G AREA IS THE AREA 110 NM UPRANGE TO 140 NM DOWNRANGE AND +/-27 NM CROSSRANGE ABOUT THE CONSTANT 4G TARGET POINTS.
	1-41	ALTERNATE MISSION---ANY DEVIATION FROM THE NOMINAL MISSION TIMELINE WHERE FURTHER MISSION OBJECTIVES ARE CONSIDERED BEFORE THE END OF THE MISSION.
	1-42	CONTINUE MISSION---THE CONTINUE MISSION RULING FOR MALFUNCTIONS INDICATES THAT THE MISSION WILL BE CONTINUED IN ACCORDANCE WITH PRESENT PLANS UNLESS OVERRIDING FACTORS ARE PRESENT WHICH WOULD CAUSE SELECTION OF AN ALTERNATE CHOICE.
	1-43	EVASIVE MANEUVER---USE OF RESIDUAL S-IVB PROPELLANTS TO ACHIEVE THE FOLLOWING IN ORDER OF PRIORITY--- 1. A REDUCTION IN THE PROBABLITY OF S-IVB AND SPACECRAFT RECONTACT. 2. A REDUCTION IN THE PROBABILITY OF S-IVB EARTH IMPACT. 3. AN INCREASE IN THE PROBABILITY OF S-IVB LUNAR IMPACT.

R	ITEM	
	1-44	LUNAR ABORT MODES AFTER EARLY LOI SHUTOFF (REFERENCE RULE 5-61 FOR ABORT MANEUVER DEFINITION) A. DPS 1. MODE-I--- 0 TO 725 FPS (APPROX LOI IGN TO 1+39) 2. MODE-II--- 725 TO 1202 FPS (APPROX 1+39 TO 2+41) 3. MODE-III--- 1202 TO COMPLETION (APPROX 2+41 TO C/O)
	1-45	SATURN L/V TIMEBASES---

TIME BASE	DEFINITION	NOMINAL INITIATE TIME
TB1	LIFTOFF TO S-IC INBOARD ENGINE CUTOFF	0+00
TB2	S-IC INBOARD ENGINE CUTOFF TO S-IC OUTBOARD ENGINE CUTOFF (S-IC/S-II STAGING)	2+15
TB3	S-IC OUTBOARD ENGINES CUTOFF TO S-II CUTOFF (S-II/S-IVB STAGING)	2+44
TB4	S-II CUTOFF TO S-IVB FIRST BURN CUTOFF	9+18
TB5	S-IVB FIRST BURN CUTOFF TO S-IVB RESTART PREPARATIONS (RESTART MINUS 9' 38'')	11+46
TB6	S-IVB RESTART MINUS 9' 38'' TO S-IVB SECOND BURN CUTOFF	2+20+48
TB7	S-IVB SECOND CUTOFF TO START OF S-IVB EVASIVE MANEUVER BURN	2+36+22
TB8	START OF EVASIVE BURN TO END OF S-IVB/IU LIFETIME.	4+14+22 (BY GROUND CMD.)

RULE NUMBERS 1-46 THROUGH 1-47 ARE RESERVED.

R	ITEM	

CRITERIA FOR TARGET POINT SELECTION

1-48 THE CRITERIA LISTED BELOW WILL BE USED WHEN CHOOSING BETWEEN TWO OR MORE TARGET POINTS. THE CRITICALITY OF THE MISSION SITUATION WILL AFFECT THE APPLICATION OF THESE CRITERIA.

	PRIORITY
ACCEPTABLE LAND MASS CLEARANCE	1
ACCEPTABLE WEATHER CONDITIONS FOR RECOVERY OPERATIONS AND CM STRUCTURAL INTEGRITY	2
CAPABILITY OF RECOVERY FORCES	3
COMMUNICATION WITH THE SPACECRAFT FROM A GROUND STATION AT LEAST 40 MINUTES PRIOR TO DEORBIT BURN*	4
SUFFICIENT DAYLIGHT FOR RECOVERY OPERATIONS	5
A GROUND STATION FOR POST-DEORBIT BURN* TRACKING	6
VOICE CONTACT PRIOR TO AND DURING DEORBIT BURN*	7
POST-BLACKOUT TRACKING DATA AVAILABLE FOR REENTRY (ASSUMES PRE-BLACKOUT ACQUISITIONS)	8
GROUND STATIONS AVAILABLE TO OBTAIN DELTA VC READOUTS AND TO PASS CREW BACKUP GUIDANCE QUANTITIES	9

*OR FINAL MCC MANEUVER

1-49 LUNAR RETURN ENTRY RANGE PRIORITY--- THE RELATIVE ENTRY RANGE (400,000 FEET TO SPLASH) PRIORITY IS AS FOLLOWS---

A. 1200 - 1400 NM (NOMINAL)

B. 1400 - 1800 NM (USED TO AVOID WEATHER VIOLATIONS IN PRIORITY A.)

C. 1800 - 2500 NM (USED TO AVOID EXTREME WEATHER VIOLATIONS IN PRIORITY A AND B.)

RULE NUMBERS 1-50 THROUGH 1-55 ARE RESERVED.

R	ITEM	
		' PRELAUNCH RULES '
	1-56	MANDATORY - THE COGNIZANT FLIGHT CONTROLLER WILL REQUEST A HOLD OR A CUTOFF FROM THE FLIGHT DIRECTOR IN CASE OF A LOSS OR FAILURE OF A MANDATORY ITEM. PRIOR TO T-1 MIN. FAILURES OF MANDATORY ITEMS WILL BE CONFIRMED PRIOR TO REQUESTING A HOLD OR A CUTOFF. AFTER T-1 MIN. CUTOFF WILL BE REQUESTED FOR MANDATORY ITEMS WITHOUT VERIFICATION DUE TO THE LIMITED TIME REMAINING. AT T-20 SEC. ALL MANDATORY ITEMS WILL REVERT TO HIGHLY DESIRABLE UNLESS SPECIFICALLY DESIGNATED AS MANDATORY TO L/O. REFERENCE THE LAUNCH MISSION RULES DOCUMENT FOR SPECIFIC PROCEDURES.
	1-57	HIGHLY DESIRABLE - THE COGNIZANT FLIGHT CONTROLLER WILL NOTIFY THE FLIGHT DIRECTOR IN CASE OF A LOSS OR A FAILURE OF A HIGHLY DESIRABLE ITEM(S). A HOLD MAY BE CALLED BY THE FLIGHT DIRECTOR TO REPAIR THIS ITEM(S) WHEN IT IS CONVENIENT AND IF THE ESTIMATED TIME TO REPAIR OR REPLACE THE ITEM(S) IS ACCEPTABLE. ALL HIGHLY DESIRABLE ITEMS REVERT TO DESIRABLE AFTER AUTO SEQUENCE START.
	1-58	DESIRABLE - FLIGHT CONTROLLERS WILL NOT CALL HOLDS FOR THE LOSS OF DESIRABLE ITEMS AS THEY ARE PLACED IN THIS CATEGORY BECAUSE THEY ARE ITEMS OF SUPPORT WHICH ARE OF MINOR IMPORTANCE TO FLIGHT OPERATIONS.
	1-59	MANUAL CUTOFF WILL NOT BE ATTEMPTED FROM T-11 SECONDS (ENGINE IGNITION) TO T-0.
		RULE NUMBERS 1-60 THROUGH 1-65 ARE RESERVED.

R	ITEM	
		' LAUNCH ABORTS '
	1-66	ABORT REQUEST COMMANDS ARE COMMANDS TRANSMITTED FROM THE MCC OR LCC WHICH ILLUMINATE THE ABORT REQUEST LIGHT ON THE COMMAND PILOT'S PANEL. THE ''ABORT LIGHT'' AND A VOICE REPORT ''ABORT'' OVER A/G ARE CONSIDERED TWO CUES FOR THE CREW TO TAKE THE NECESSARY ACTION TO ABORT THE MISSION. THE GROUND WILL USE TWO INDEPENDENT CUES PRIOR TO TRANSMITTING ''ABORT REQUEST.'' ADDITIONAL CUES FOR THE CREW WILL COME FROM ONBOARD INDICATIONS.
	1-67	ABORT ACTION CAN BE INITIATED ONLY BY THE CREW OR THE EDS.
	1-68	WHENEVER POSSIBLE, ALL ABORTS AND EARLY MISSION TERMINATIONS WILL BE TIMED FOR A WATER LANDING.
	1-69	THE FLIGHT DIRECTOR WILL INITIATE THE ABORT REQUEST FOR SPACECRAFT SYSTEM MALFUNCTIONS.
	1-70	THE FLIGHT DYNAMICS OFFICER WILL INITIATE THE ABORT REQUEST COMMAND DURING THE FLIGHT PHASE IF THE SPACE VEHICLE EXCEEDS THE FLIGHT DYNAMICS ENVELOPE.
	1-71	THE BOOSTER SYSTEMS ENGINEER WILL INITIATE THE ABORT REQUEST COMMAND BASED UPON LAUNCH VEHICLE TIME-CRITICAL SYSTEMS MALFUNCTIONS THAT WOULD NOT ALLOW A SAFE INSERTION OR CONTINUATION TO A FLIGHT DYNAMICS LIMIT LINE.
	1-72	THE ONLY KSC POSITION THAT WILL HAVE ABORT REQUEST CAPABILITY IS THE LAUNCH OPERATIONS MANAGER. THE LAUNCH OPERATIONS MANAGER MAY SEND AN ABORT REQUEST FROM THE TIME THE LAUNCH ESCAPE SYSTEM IS ARMED UNTIL THE SPACE VEHICLE REACHES SUFFICIENT ALTITUDE TO CLEAR THE TOP OF THE UMBILICAL TOWER. PRIOR TO TRANSFER OF CONTROL TO THE FLIGHT DIRECTOR, THE LAUNCH OPERATIONS MANAGER WILL INITIATE THE ABORT REQUEST COMMAND FROM KSC BASED ON THE CRITERIA DEFINED IN THE LMRD. THESE INCLUDE--- A. MAJOR STRUCTURAL FAILURE OR EXPLOSION. B. NEGATIVE VERTICAL MOTION. C. UNCONTROLLABLE VEHICLE TILTING. D. CATASTROPHIC FIRES PRIOR TO LIFTOFF.
	1-73	THE RSO CAN SHUTDOWN THE SLV BY TRANSMITTING THE MFCO COMMAND WHICH ALSO LIGHTS THE ABORT REQUEST LIGHT IN THE SPACECRAFT. THE MFCO WILL INITIATE AN AUTO-ABORT IF TRANSMITTED PRIOR TO EDS DISABLE. THE MFCO COMMAND INITIATES A 4.1 SEC TIMER ON THE GROUND (CAPE RSO CONSOLE ONLY, BRSO INSERTS MANUAL TIME DELAY.) WHICH IN TURN ENABLES DESTRUCT CAPABILITY IF TRANSMITTED. THE RSO DESTRUCT COMMAND CAN THEN DESTROY THE SLV. THE RSO WILL ALWAYS SAFE THE S-IVB AFTER TRANSMITTING MFCO UPON VERIFICATION OF CUTOFF IF THE DESTRUCT COMMAND IS NOT TO BE TRANSMITTED.

R | ITEM

1-74 THE RSO WILL SAFE THE S-IVB DESTRUCT SYSTEM AFTER CONFIRMATION OF S-IVB C/O FROM THE FLIGHT DYNAMICS OFFICER. IF COMMUNICATIONS ARE LOST WITH THE FIDO, THE S-IVB DESTRUCT SYSTEM WILL BE SAFED BASED ON THE RSO'S VERIFICATION OF S-IVB CUTOFF. ONCE SAFED, THE S-IVB DESTRUCT SYSTEM CANNOT BE REINITIATED. IF THE RSO INITIATES MFCO, THE RSO WILL INITIATE SAFING AFTER VERIFICATION OF S-IVB CUTOFF.

1-75 EMERGENCY ENGINE SHUTDOWN METHODS.

INITIATOR	METHOD	STAGE	TIME FRAME
ASTRONAUT	CCW ON THC	S-IC, S-II, S-IVB	T + 30 SEC. TO S-IVB CUTOFF
ASTRONAUT	S-II/ S-IVB L/V STAGE SWITCH	S-II, S-IVB	T + 2-43 TO S-IVB CUTOFF
RSO	RF CMD (MFCO)	S-IC, S-II, S-IVB	T-0 TO S-IVB CUTOFF
EDS	2 OF 3 VOTING LOGIC	S-IC	T + 30 SEC TO EDS AUTO OFF AT T+ 2-00 MIN NOTE---EDS WILL INITIATE ABORT FROM T-0 TO T + 30 SEC. HOWEVER, S-IC ENGINES WILL NOT BE SHUTDOWN

1-76 THE AUTOMATIC EDS (TWO ENGINE OUT AND OVERRATE AUTO-ABORT CAPABILITIES) WILL BE FLOWN CLOSED LOOP UNTIL T + 02-00. DURING LAUNCH, MALFUNCTIONS AFFECTING EDS OPERATION WILL BE MANAGED AS FOLLOWS---

THE EDS AUTO SWITCH WILL BE TURNED OFF WHENEVER ANY TWO CSM ENTRY BATTERIES ARE TIED TO THE SAME MAIN BUS OR FOR CONFIRMED LOSS OF ANY CSM ENTRY BATTERY.

R	ITEM	
	1-77	ABORT MODES---

MODE I — BOUNDARY OF APPLICATION

1A	LES ABORT ENABLE (APPROX. T-45 MIN) TO GET 42 SEC. (10 K FEET)
1B	GET 42 SEC TO 100K FEET ALTITUDE (GET APPROX. 1 + 50)
1C	100K FEET ALTITUDE TO TOWER JETTISON (GET APPROX. 3 + 07)

1-78 MODE II — BOUNDARY OF APPLICATION — PROCEDURES

TOWER JETTISON (GET APPROX. 3 + 07) UNTIL FULL LIFT SPLASHPOINT IS 3200 NM DOWNRANGE (GET APPROX. 10+13)

A. MCC PROVIDES
   1. GET OF 300K
   2. PITCH AT .05G
   3. GET DROGUE

B. ENTRY IS FULL LIFT

R	ITEM			
	1-79	MODE III	BOUNDARY OF APPLICATION BETWEEN FULL LIFT SPLASH POINT =3200 NM AND INSERTION.	PROCEDURES A. MCC PROVIDES--- 1. GETI AT S-IVB CUTOFF PLUS 2-05 2. DELTA V FOR 3350 NM SPLASH POINT 3. BURN DURATION 4. GET OF 300K 5. PITCH AT .05G 6. GET DROGUE B. MANEUVER IS SCS AUTO. C. ENTRY IS ROLL LEFT 55 DEGREES.
			NOTE MODE III "NO BURN" WILL BE CALLED IF THE ROLL LEFT 55 DEG. ENTRY RANGE IS LESS THAN 3350 NM.	
	1-80	MODE IV	BOUNDARY OF APPLICATION CONTINGENCY ORBIT INSERTION CAPABILITY TO INSERTION (BASED ON COI LINE ON GAMMA VS V PLOT FOR NEAR NOMINAL ALTITUDE)	PROCEDURES A. MCC PROVIDES--- 1. GETI AT S-IVB CUTOFF PLUS 2-05 2. DELTA V REQUIRED TO ACHIEVE PERIGEE GREATER THAN OR EQUAL TO 75 NM 3. BURN DURATION 4. PITCH AT GETI B. MANEUVER IS SCS AUTO
	1-81	MODE APOGEE KICK	BOUNDARY OF APPLICATION PRE-APOGEE CUTOFF, OUTSIDE THE COI BOUNDARY, CORRECTABLE TO SAFE ORBITAL CONDITIONS BY A MANEUVER AT APOGEE.	PROCEDURES A. MCC PROVIDES--- 1. GETI FOR BURN AT APOGEE 2. DELTA V REQUIRED TO ACHIEVE PERIGEE GREATER THAN OR EQUAL TO 75 NM 3. BURN DURATION 4. PITCH ATTITUDE B. MANEUVER IS SCS AUTO
		RULES 1-82 THROUGH 1-86 ARE RESERVED		

' CREW ABORT LIMITS '

R	ITEM		
	1-87	MAX Q REGION	PROCEDURES
		A. (00-50 TO 02-00) AOA GREATER THAN OR EQUAL TO 100 PCT AND ROLL, PITCH, OR YAW ERROR GREATER THAN OR EQUAL TO 5 DEGREES (NOT APPLICABLE TO ANY ENGINE OUT PRIOR TO 50 SEC.)	ABORT MODE I (ACTION ONLY AFTER BOTH HAVE REACHED THRESHOLD.)
	1-88	RATES AND ATTITUDE	PROCEDURES
		A. PITCH AND YAW 1. L/O TO 2 MIN - 4 DEG/SEC 2. 2 MIN TO S-IVB CUTOFF - 9 DEG/SEC 3. YAW ERROR GREATER THAN 45 DEG.	ABORT MODE I ABORT MODE I, MODE II, MODE III, OR MODE IV
		B. ROLL 1. L/O TO S-IVB CUTOFF - 20 DEG/SEC	ABORT MODE I, MODE II, MODE III, OR MODE IV
	1-89	EDS AUTOMATIC ABORT LIMITS (UNTIL MANUAL DEACTIVATION OF TWO ENGINES OUT AUTO AND LV RATES AT 2-00 MIN)	
			BOUNDARY OF APPLICATION
		A. RATES PITCH AND YAW ROLL	 4.0 +/- .5 DEG/SEC 20.0 +/- .5 DEG/SEC
		B. ANY TWO ENGINES OUT	
		C. CM TO IU BREAKUP	
	1-90	S-IVB TANK PRESSURE LIMITS	
		A. BULKHEAD DELTA P (FIRST SIVB C/O TO S/C L/V SEP) FUEL GREATER THAN OXID = 26 PSID OXID GREATER THAN FUEL = 36 PSID	
		B. LOX TANK PRESS GREATER THAN OR EQUAL TO 50 PSIA (L/O TO S/C L/V SEP)	
	1-91	ENGINE FAILURES	PROCEDURES
		LOSS OF 3 OR MORE S-II ENGINES	ABORT MODE I, OR MODE II
		PRIOR TO S-IVB TO COI CAPABILITY	

R	ITEM	
		' GENERAL '
	2-1	PRELAUNCH A. LAUNCH AZIMUTH LIMITATIONS RESTRICT LAUNCHES TO OCCUR BETWEEN 72 DEG. AND 96 DEG. B. THE FLIGHT DIRECTOR WILL EVALUATE WIND SIMULATIONS ALONG THE MODE 1 (TOWER) ABORT TRACK PRIOR TO THE START OF CRITICAL COUNTDOWN ACTIVITIES AND WILL ADVISE THE LAUNCH DIRECTOR OF ANY PREDICTED PERIODS OF LAND LANDING. IF THE FLIGHT DIRECTOR IS UNABLE TO PROVIDE THIS EVALUATION, A LAND LANDING WILL BE ASSUMED AND THE SPACECRAFT WIND CONSTRAINTS FOR LAND IP'S WILL BE APPLIED. THESE CONSTRAINTS (REF LMRD) REQUIRE THAT THE SPACECRAFT NOT BE LAUNCHED OR REMAIN IN A TOWER ABORT MODE IF A TOWER ABORT WOULD RESULT IN A LAND LANDING WITH A HORIZONTAL VELOCITY COMPONENT OF GREATER THAN 54 FEET PER SECOND AT IMPACT. IN ALL CASES, THE LAUNCH DIRECTOR WILL BE PRIME FOR CALLING HOLDS FOR LAND LANDING LAUNCH WIND VIOLATIONS. C. THE LAUNCH WILL NOT BE ATTEMPTED IF THE MINIMUM GROUND INSTRUMENTATION CAPABILITY IS COMPROMISED. (REFERENCE SECTION 4 - GROUND INSTRUMENTATION REQUIREMENTS.) CONTINUOUS VOICE, TELEMETRY, AND TRACKING COVERAGE FOR THE SPACECRAFT IS REQUIRED FROM LIFTOFF THROUGH INSERTION PLUS 60 SEC. CONTINUOUS TELEMETRY COVERAGE IS REQUIRED FROM THE SLV FROM LIFTOFF THROUGH INSERTION PLUS 60 SEC. COMMAND IS HIGHLY DESIRABLE FOR BOTH VEHICLES.
	2-2	LAUNCH IT IS PREFERABLE TO GO INTO ORBIT AND REENTER INTO THE WEST ATLANTIC RATHER THAN PERFORM A LAUNCH ABORT. THEREFORE, THE LAUNCH WILL BE CONTINUED AS LONG AS THE CREW CONDITION IS SATISFACTORY, NO S/C OR SLV PROBLEMS EXIST WHICH JEOPARDIZE CREW SAFETY, AND SUFFICIENT CONSUMABLES, COOLANT, AND ELECTRICAL ENERGY REMAIN FOR AT LEAST ONE REVOLUTION PLUS ENTRY.

R	ITEM
	2-3

EARTH ORBIT

A. ENTRY WILL BE MADE AT THE NEXT BEST PTP WHEN ONE MORE CSM FAILURE WILL RESULT IN AN ASAP ENTRY OR UNCONTROLLABLE CONDITIONS.

B. ADEQUATE CONSUMABLES WILL BE MAINTAINED FOR ENTRY IN THE NEXT PTP, MAKING ALLOWANCES FOR SETUP AND ENTRY.

C. THE DEORBIT CAPABILITIES REQUIRED FOR EARTH ORBIT ARE---

1. TWO METHODS OF DEORBIT ARE REQUIRED.

2. IF A SUBSEQUENT SINGLE FAILURE WOULD PRECLUDE DEORBIT BY EITHER METHOD REMAINING, THE CSM WILL DEORBIT.

3. SPS IS THE PRIME METHOD OF DEORBIT AND SUFFICIENT DELTA V WILL BE RESERVED FOR THIS MANEUVER.

4. SM-RCS (4 QUAD) AND SM-CM/RCS HYBRID WILL BE CONSIDERED AS INDEPENDENT DEORBIT METHODS AS LONG AS INDIVIDUAL SM-RCS QUAD AND GNCS INTEGRITY IS MAINTAINED AND SUFFICIENT RCS PROPELLANT IS AVAILABLE.

5. THE LM PROPULSION SYSTEM (DPS OR RCS) MAY BE USED TO PLACE THE CSM IN AN ORBIT (HP GREATER THAN OR EQUAL TO 80 NM) FROM WHICH A SM-RCS OR SM-CM/RCS HYBRID DEORBIT CAN BE CONDUCTED.

6. UTILIZATION OF BACKUP DEORBIT METHODS WILL BE BASED ON THE FOLLOWING PRIORITIES---

(A) SM-RCS

(B) LM PROP PLUS SM-RCS

(C) SM-CM/RCS HYBRID

(D) LM PROP PLUS SM-CM/RCS HYBRID

RULE NUMBERS 2-4 THROUGH
2-10 ARE RESERVED

R	ITEM	
	2-11	TRANSLUNAR INJECTION A. THE TLI WILL BE GO IF THE S/C AND L/V SATISFY THE FOLLOWING CRITERIA--- 1. THERE HAVE BEEN NO FAILURES IN THE LAUNCH VEHICLE WHICH RESULTS IN --- (A) A CATASTROPHIC HAZARD. (B) ACHIEVEMENT OF AN S-IVB ENGINE BURN WITH EXPECTED CUTOFF OR SHUTDOWN CONDITIONS DEFINITELY PRECLUDING AN ACCEPTABLE LUNAR LANDING MISSION. IN APPLYING THIS CRITERIA TO SPECIFIC MISSION RULES, A NO GO RECOMMENDATION WILL BE REQUIRED IF INSUFFICIENT S-IVB CONSUMABLES ARE AVAILABLE TO ACHIEVE A LUNAR LANDING MISSION. 2. THE CSM HAS TOTAL SYSTEMS CAPABILITY WITH REDUNDANCY. REDUNDANCY VERIFICATION IS SUBJECT TO THE NUMBER AND TYPE OF REDUNDANT COMPONENT CHECKS WHICH CAN BE PERFORMED IN EARTH ORBIT. B. THE TLI MANEUVER WILL BE DELAYED UNTIL THE SECOND OPPORTUNITY FOR SUSPECTED FAILURE OF A CRITICAL SYSTEM (PRIME OR BACKUP) (MANEUVER, LIFE SUPPORT, COOLING, POWER, SEQUENTIAL, COMMUNICATIONS) WHICH REQUIRES TIME FOR EVALUATION.
	2-12	TRANSPOSITION, DOCKING AND EJECTION (TD&E) A. THE NORMAL MINIMUM CABIN PRESSURE REDLINE OF 4.0 PSIA FOR TUNNEL/LM PRESSURIZATION SEQUENCES MAY BE WAIVED DURING TD&E. FOR TUNNEL OR LM LEAKS WHICH PREVENT NORMAL PRESSURIZATION, THE CM WILL BE DEPRESSURIZED AS REQUIRED FOR HATCH REMOVAL AND UMBILICAL HOOKUP. B. IF NORMAL LM EJECTION IS NOT SUCCESSFUL, NO ATTEMPT WILL BE MADE TO MAN THE LM AND ''STAGE'' TO RECOVER THE ASCENT STAGE.

R	ITEM	
	2-13	TRANSLUNAR COAST A. NO MCC WILL BE PERFORMED IF LOI CAN BE TARGETED WITHIN OPERATIONAL CONSTRAINTS. B. TRANSLUNAR COAST WILL BE TERMINATED IF ADEQUATE CONSUMABLES (CSM AND/OR LM) ARE NOT AVAILABLE FOR A CIRCUMLUNAR EARTH RETURN + 12 HRS, AND A TLC DIRECT ABORT PROVIDES AN EARLIER LANDING TIME. C. THE CREW WILL MAN THE LM FOR BACKUP COMMUNICATIONS IF CSM COMMUNICATIONS ARE LOST WITH THE MSFN. IF CSM COMMUNICATIONS CANNOT BE MAINTAINED, A LUNAR ORBIT MISSION WILL NOT BE FLOWN. D. A HYBRID TRAJECTORY WILL NOT BE FLOWN UNLESS THE CSM SYSTEMS MEET THE LOI CRITERIA. FOR A CSM SOLO MISSION, RCS CAPABILITY TO RETURN TO A FREE RETURN TRAJECTORY IS REQUIRED. E. TRANSLUNAR MIDCOURSE CORRECTIONS RESULTING IN A HYBRID TRAJECTORY WILL BE DESIGNED TO MEET LOI TARGETING CONSTRAINTS WHILE RESERVING A CAPABILITY TO PERFORM A RETURN TO EARTH MANEUVER WITH THE DPS ENGINE AS LATE AS 2 HRS AFTER PERILUNE ON THE CIRCUMLUNAR TRAJECTORY.
	2-14	LUNAR ORBIT INSERTION LOI WILL BE INHIBITED AND A LUNAR FLYBY PERFORMED IF THE CSM DOES NOT SATISFY ANY OF THE FOLLOWING CONDITIONS--- A. FULL CRITICAL SYSTEMS REDUNDANCY. B. ADEQUATE CONSUMABLES FOR MINIMUM LUNAR ORBIT OPERATIONS WITH CAPABILITY TO SUSTAIN A TANK LOSS AND RETURN TO EARTH WITH AN AVERAGE POWER LEVEL OF 40 AMPS. C. SPS PROPELLANT RESERVE CAPABILITY FOR TEI AND TRANSEARTH MCC'S. D. RCS PROPELLANT RESERVE TO ACCOMPLISH TEI CONTROL, TRANSEARTH MCC CONTROL, PTC, AND MINIMUM LUNAR ORBIT OPERATIONS. E. A DPS LOI WILL BE PERFORMED IF REQUIRED TO ACCOMPLISH A LUNAR ORBIT MISSION.
	2-15	LUNAR ORBIT A. LOI DISPERSIONS 1. IF A STABLE ORBIT HAS NOT BEEN ACHIEVED, A DPS 2 HOUR ABORT WILL BE EXECUTED FOLLOWED BY A SUBSEQUENT DPS (OR APS) MANEUVER IF REQUIRED. 2. IF A STABLE ORBIT HAS BEEN ACHIEVED, AN SPS OR DPS TEI WILL BE PERFORMED AT THE NEXT OPPORTUNITY OR AN ALTERNATE MISSION WILL BE FLOWN. B. DESIGNED REDUNDANT CAPABILITY MUST BE MAINTAINED IN ALL CSM SYSTEMS CRITICAL FOR TEI AND LIFE SUPPORT. C. SUFFICIENT CONSUMABLES MUST REMAIN TO COMPLETE THE NEXT MISSION PHASE WITH CAPABILITY TO SUSTAIN A TANK LOSS AT ANY POINT DURING THE PHASE AND RETURN TO EARTH WITH AN AVERAGE POWER LEVEL OF 40 AMPS. D. THE CSM MUST MAINTAIN AN SPS FUEL RESERVE CAPABILITY FOR THE TEI MANEUVERS AND TRANSEARTH MCC'S. E. THE CSM MUST MAINTAIN RCS PROPELLANT RESERVE TO ACCOMPLISH TEI CONTROL, TRANSEARTH MCC CONTROL, PTC, AND MINIMAL TRANSEARTH OPERATIONS. F. IF NORMAL MISSION OPERATIONS ARE INHIBITED, THE DPS WILL BE USED FOR TEI WHEN THERE IS A CHOICE BETWEEN THE DPS AND SPS.
	2-16	INTRAVEHICULAR TRANSFER ONE HARDSUIT IVT FROM THE CSM TO THE LM WILL BE ACCOMPLISHED IF A REASONABLE CHANCE EXISTS THAT CORRECTIVE ACTION CAN BE TAKEN FOR A LM/TUNNEL PRESSURIZATION PROBLEM.

R	ITEM	
	2-17	DOCKED LM OPERATION FOR AN IMPENDING HAZARDOUS SITUATION RESULTING FROM A DESCENT STAGE PROBLEM, THE STAGE WILL BE JETTISONED AND ASCENT STAGE OPERATIONS WILL CONTINUE AFTER THE VEHICLE HAS MOVED TO A SAFE DISTANCE.
		RULE NUMBERS 2-18 THROUGH 2-20 ARE RESERVED
	2-21	CSM/LM UNDOCKING AND SEPARATION A. A MANNED LM WILL NOT BE UNDOCKED FROM THE CSM WITHOUT INDEPENDENT MANEUVER CAPABILITY OF BOTH VEHICLES TO TERMINATE UNDOCKED ACTIVITIES AND TO ACCOMPLISH DOCKING. THE LM CAPABILITY TO REDOCK MUST STILL EXIST IF THE LM IS REQUIRED TO STAGE. B. EVT CAPABILITY IS REQUIRED FOR MANNED UNDOCKING. C. CREWMEN WILL BE SUITED DURING UNDOCKING AND DOCKING. D. VHF COMMUNICATIONS IS MANDATORY FOR SEPARATION.
	2-22	CSM LUNAR ORBIT UNDOCKED A. UNDOCKING TO PDI 1. LOSS OF REDUNDANT CAPABILITY IN CRITICAL SYSTEMS WILL BE CAUSE TO TERMINATE THE MISSION AND PERFORM TEI ASAP. 2. LOSS OF CSM RESCUE CAPABILITY WILL BE CAUSE FOR TERMINATING THE MISSION AND PERFORMING A LM ACTIVE RDZ ASAP. B. PDI TO LANDING NO CSM FAILURES WILL BE CAUSE FOR ABORT DURING POWERED DESCENT EXCEPT THOSE CONFIRMED SPS FAILURES REQUIRING RETENTION OF LM PROPULSION CAPABILITY. C. LUNAR STAY FAILURE TO MAINTAIN REDUNDANT CAPABILITY IN SYSTEMS REQUIRED FOR TEI OR LIFE SUPPORT WILL BE CAUSE FOR TERMINATION OF LUNAR STAY.
	2-23	RESERVED
	2-24	LM-PDI FOR PDI, THE LM MUST MEET THE LUNAR STAY WITH EVA CRITERIA, HAVE THE CAPABILITY TO LAND, ASCEND, RENDEZVOUS AND DOCK WITHOUT VIOLATING ANY SPECIFIC MISSION RULES OR REDLINES.

R	ITEM	
	2-25	LM-POWERED DESCENT
		IF A SYSTEMS FAILURE OCCURS AND A CHOICE IS AVAILABLE---
		A. EARLY IN POWERED DESCENT WHEN OPS-TO-ORBIT CAPABILITY IS AVAILABLE, IT IS PREFERABLE TO ABORT IN FLIGHT THAN TO CONTINUE DESCENT. REDUNDANT CAPABILITY OF CRITICAL LM SYSTEMS IS REQUIRED TO CONTINUE POWERED DESCENT DURING THIS PERIOD. HOWEVER, FOR FAILURES EFFECTING VEHICLE LIFETIME (CONSUMABLES, COOLANT) CONSIDERATION WILL BE GIVEN TO CONTINUING POWERED DESCENT TO PDI + 6+30 IN ORDER TO ACHEIVE A SHORTER RENDEZVOUS.
		B. DURING THE REMAINDER OF POWERED DESCENT, IT IS PREFERABLE TO LAND AND LAUNCH FROM THE LUNAR SURFACE THAN TO ABORT. ONLY THOSE SYSTEMS FAILURES OR TRENDS THAT INDICATE IMPENDING LOSS OF THE CAPABILITY TO LAND, ASCEND AND ACHIEVE A SAFE ORBIT FROM THE LUNAR SURFACE, OR IMPENDING LOSS OF LIFE SUPPORT CAPABILITY WILL BE CAUSE FOR ABORT DURING THIS PERIOD.
	2-26	LM-LUNAR STAY
		A. ONLY THOSE TIME-CRITICAL SYSTEMS FAILURES OR TRENDS THAT INDICATE IMPENDING LOSS OF THE CAPABILITY TO ASCEND AND ACHIEVE A SAFE ORBIT WILL BE CAUSE FOR AN IMMEDIATE ABORT (ANYTIME LIFTOFF) FROM THE LUNAR SURFACE.
		B. LOSS OF REDUNDANT CAPABILITY IN CRITICAL LM SYSTEMS IS CAUSE FOR ABORT AT THE NEXT BEST OPPORTUNITY.
	2-27	EVA
		A. FOR THE NOMINAL (TWO-MAN) EVA, TOTAL EMU LIFE SUPPORT SYSTEMS CAPABILITY, EVA TO EVA DUPLEX VOICE, EVA TO MSFN VOICE FROM ONE CREWMAN, AND CRITICAL INSTRUMENTATION FOR BOTH ASTRONAUTS ARE REQUIRED.
		B. ALL PLANNED EVA'S WILL INCLUDE A 30-MINUTE POST-EVA RESERVE ON EMU CONSUMABLES.
		C. ALL EVA EXCURSIONS WILL BE LIMITED TO A MAXIMUM BSLSS OPERATIONAL RADIUS OF 3KM AND A MAXIMUM OPS OPERATIONAL RADIUS OF 1KM. 300 BTU'S ARE CONSIDERED THE MAXIMUM ACCEPTABLE CREW HEAT STORAGE.
		D. BOTH EVA CREWMEN WILL NOT REMAIN OUTSIDE OF MSFN COMM COVERAGE FOR A PERIOD EXCEEDING 5 MIN.
		E. FOR THE TWO-MAN EVA, THE CDR WILL ALWAYS EGRESS FIRST AND INGRESS LAST UNLESS THE CDR HAS INITIATED AN OPS PURGE. THIS WILL INSURE THAT THE CDR IS IN THE LEFT PILOT POSITION SHOULD ASCENT BE REQUIRED WITHOUT AN OPPORTUNITY TO DOFF THE EMU'S.
		F. THE LM WILL NOT BE PRESSURIZED WITH A CREWMAN ON THE SURFACE.
		G. A VACUUM TRANSFER WILL ONLY BE ATTEMPTED IN AN EMERGENCY.
		H. IF FAILURES PRECLUDE THE INITIATION OR CONTINUATION OF A TWO-MAN EVA, A ONE-MAN EVA WILL BE INITIATED. ONE MAN EVA'S WILL BE LIMITED TO AN OPERATIONAL RADIUS OF 1000 FEET FROM THE LM. THE PRIMARY OBJECTIVE WILL BE ALSEP DEPLOYMENT WITH ADDITIONAL OBJECTIVES IDENTIFIED IN REAL-TIME.
		I. BOTH PLSS'S AND OPS'S WILL BE RETAINED UNTIL TWO LIFE SUPPORT UNITS (2 OPS, 2 PLSS, OR 1 PLSS + 1 OPS) HAVE BEEN VERIFIED TO HAVE SUFFICIENT CONSUMABLES TO SUPPORT CEVT.
		J. THE ACTIVATION OF THE OPS IN THE MAKEUP MODE OR OF THE BSLSS (WITH SUFFICIENT CONSUMMABLES) WILL REQUIRE EXPEDITIOUS COMPLETION OF THE SPECIFIC ACTIVITY BEING PERFORMED FOLLOWED BY IMMEDIATE RETURN TO THE LM. ACTIVATION OF THE OPS IN HIGH OR LOW PURGE MODE WILL REQUIRE IMMEDIATE RETURN TO THE LM.
		K. THE AMOUNT OF SCIENTIFIC EQUIPMENT & PAYLOAD TAKEN INTO THE ASCENT STAGE WILL BE LIMITED SO AS NOT TO REQUIRE A DEPRESSURIZATION TO JETTISON EXCESS WEIGHT PRIOR TO ASCENT.
		L. NO EVA ACTIVITIES WILL BE CONDUCTED IN THE IMMEDIATE LINE OF FIRE AREA OF THE ASE MORTER BOX AFTER REMOVAL OF THE GRENADE SAFETY RELEASE ASSEMBLY.

R	ITEM	
	2-28	ASCENT IN THE EVENT OF PROCEDURAL ERRORS OR SYSTEMS PROBLEMS WHICH RESULT IN LOSS OF SOME CAPABILITY USED FOR ASCENT OR FOR RENDEZVOUS AND WHICH CAN BE CORRECTED IN ONE REV, IT IS BETTER TO DELAY ASCENT FOR ONE REV AND CORRECT THE SITUATION THAN IT IS TO LIFT OFF ON TIME.
	2-29	RENDEZVOUS A. SELECTION OF THE ACTIVE VEHICLE FOR RENDEZVOUS AND DOCKING WILL BE DETERMINED BY THE FLIGHT DIRECTOR AND THE FLIGHT CREW BASED UPON CONSUMABLES AND SYSTEMS PERFORMANCE. THE TOTAL LM CAPABILITY WILL BE DEDICATED TO ACCOMPLISHING THE RENDEZVOUS. B. THE SHORT RNDZ PROFILE WILL BE PERFORMED IF THE MANDATORY CSM AND LM SYSTEM CONSTRAINTS CAN BE MET AND ALL PLANE ERROR CAN BE CORRECTED WITH ASCENT YAW STEERING. FOR ANY OTHER CASE, THE LONG RNDZ (CSI, CDH) PROFILE WILL BE EXECUTED.
	2-30	RETENTION OF THE LM ASC STAGE CONSIDERATION WILL BE GIVEN TO RETAINING THE ASC STAGE TO PROVIDE REDUNDANT CAPABILITY AFTER CSM SYSTEM FAILURES. THE DELTA VELOCITY RESERVED FOR WEATHER AVOIDANCE MAY BE TRADED- OFF TO ACCOMPLISH A FASTER EARTH RETURN TIME
	2-31	TRANSEARTH COAST A. THE STEEP TARGET LINE WILL BE USED FOR ALL MCC'S EXCEPT WHEN BOTH THE VELOCITY AT ENTRY INTERFACE IS LESS THAN 31,000 FPS AND THE G&N IS GO - THEN THE SHALLOW TARGET LINE WILL BE USED. B. MCC'S MAY BE USED FOR LANDING AREA CONTROL PRIOR TO ENTRY INTERFACE MINUS 24 HOURS FOR RECOVERY ACCESS VIOLATIONS, UNACCEPTABLE WEATHER, OR LAND MASSES IN ANY PART OF THE OPERATIONAL FOOTPRINT. C. IF THE FLIGHTPATH ANGLE IS OUTSIDE THE ENTRY CORRIDOR, AN MCC WILL BE EXECUTED AS SOON AS PRACTICAL. D. MCC'S WILL BE ACCOMPLISHED BY THE SPS IF NECESSARY TO MAINTAIN RCS REDLINES.
	2-32	ALTERNATE MISSION A. E.O. 1. CSM ONLY - APPROXIMATE 100 NM E.O. PHOTOGRAPHY, SPS INCLINATION CHANGE, SPS MNVR TO LOWER APOGEE IF REQUIRED. 2. CSM/LM - LM SYSTEMS POWER UP AND DPS MNVR TO LOWER APOGEE IF REQUIRED, APPROXIMATE 100 NM E.O. PHOTOGRAPHY MISSION, INCLINATION CHANGE. B. L.O. 1. CSM ONLY - LUNAR ORBIT PHOTOGRAPHY, REMAIN WITHIN RCS CAPABILITY TO RETURN TO A FREE RETURN TRAJ. 2. CSM/LM (NO LANDING CAPABILITY) - LM SYSTEMS POWER UP, LO PHOTOGRAPHY, PC MANEUVER. C. IN ANY ALTERNATE MISSION WITHIN THE CONSTRAINTS OF PROPELLANT REMAINING AND OTHER OPERATIONAL CONSIDERATIONS SUCH AS CREW SAFETY AND SYSTEMS LIFETIME, THE COMBINED LM ASC/DES STAGES WILL BE DISPOSED OF IN THE FOLLOWING ORDER OF DESCENDING PRIORITY--- 1. LUNAR IMPACT 2. OCEAN IMPACT 3. LUNAR ORBIT

3 MISSION RULE SUMMARY

R	ITEM	

THIS SECTION IS A SUMMARY OF THE DATA PRIORITY GUIDELINES BY MISSION PHASE, SLV RULES BY MISSION PHASE, AND SYSTEMS GO/NO-GO CRITERIA ON CHARTS BY MISSION PHASE.

THE SUMMARY RULES PLUS THE CHART ARE REQUIRED TO ENCOMPASS EACH PHASE.

THE CAPABILITY LISTED IN THE CHARTS ARE THE REQUIREMENTS FOR INITIATION OR CONTINUATION OF A MISSION PHASE OR EVENT. MISSION EVENTS FROM UNDOCKING TO PDI IGNITION REQUIRE THAT THE VEHICLES MEET THE LUNAR STAY WITH EVA CRITERIA AND HAVE THE CAPABILITY TO LAND, ASCEND, RENDEZVOUS, AND DOCK.

' LAUNCH PHASE '

3-1 THE LAUNCH WILL BE ABORTED FOR THE FOLLOWING REASONS---

A. SLV

S-II GIMBAL ACTUATOR HARDOVER INBOARD PRIOR TO S-IVB TO COI CAPABILITY

VIOLATION OF AUTO/MANUAL EDS LIMITS

S-II ENGINE FAILURES (TIME DEPENDENT)

FAILURE OF SECOND PLANE SEPARATION

S-IVB LOSS OF HYDRAULIC FLUID (PRIOR TO S-IVB IGNITION)

S-IVB LOSS OF THRUST (TIME DEPENDENT) (POSSIBLE COI CAPABILITY)

S-IVB LOX TANK PRESS GREATER THAN 50 PSI BEFORE TWR JETT

B. CSM

1. ENVIRONMENTAL

LOSS OF CABIN AND SUIT PRESSURE

LOSS OF CABIN PRESSURE AND SUIT CIRCULATION

FIRE/SMOKE IN CM

LOSS OF CABIN PRESSURE AND O2 MANIFOLD LEAK

2. ELECTRICAL

THE FOLLOWING POWER SOURCES ARE REQUIRED TO CONTINUE LAUNCH:
- 1 F/C OR AUX BATT PLUS 1 ENTRY BATT, OR
- 3 ENTRY BATTS

UNCONTROLLABLE SHORTED MAIN BUS

LOSS OF BOTH AC BUSES DURING MODE I OR MODE II

3. PROPULSION

SUSTAINED LEAK OR LOSS OF HE PRESSURE (SOURCE OR MANIFOLD) IN BOTH CM-RCS RINGS (MODE I ONLY)

C. VIOLATION OF TRAJECTORY LIMIT LINES

D. TEAM DISCRETION WILL BE USED FOR---

1. SUIT/CABIN CONTAMINATION

2. MEDICAL PROBLEMS

R	ITEM	
	3-2	THE S-IVB EARLY STAGING WILL BE USED AFTER ''S-IVB TO COI'' CAPABILITY FOR THE FOLLOWING --- S-II GIMBAL ACTUATOR INBOARD HARDOVER S-II ENGINE FAILURES (TIME DEPENDENT) S-IVB COLD HE SHUTOFF VALVE(S) FAILS OPEN (AFTER TWR JETT)
	3-3	SWITCHOVER TO CSM GUIDANCE WILL BE PERFORMED FOR-- SATURN GUIDANCE REFERENCE FAILURE
		RULE NUMBERS 3-4 THROUGH 3-10 ARE RESERVED.

R	ITEM	
		' EARTH ORBIT '
	3-11	CSM SEPARATION FROM THE S-IVB (WITHOUT LM EXTRACTION) WILL BE PERFORMED EARLY FOR THE FOLLOWING SLV CONDITIONS (CONSIDERATION WILL BE GIVEN TO EXTRACTING THE LM LATER IF THE CONDITION CAN BE CORRECTED) *S-IVB RANGE SAFETY PROPELLANT DISPERSAL SYSTEM ARMS INADVERTENTLY AFTER INSERTION AND PRIOR TO SAFING *S-IVB LOX TANK PRESS IS GREATER THAN 50 PSI LOSS OF ATTITUDE CONTROL DURING TB5 *S-IVB COMMON BULKHEAD DELTA PRESSURE EXCEEDS LIMITS *START BOTTLE GREATER THAN 1800 PSIA *PERFORM SPS MANEUVER TO A SAFE DISTANCE
	3-12	CSM SEPARATION FROM THE S-IVB (WITH LM EXTRACTION) WILL BE PERFORMED FOR--- A. S-IVB NO-GO FOR TLI B. CSM NO-GO FOR TLI BUT GO FOR EARTH ORBIT MISSION
	3-13	TLI WILL BE INHIBITED FOR--- INSUFFICIENT PROPELLANT REMAINS FOR ACHIEVING A 105K NM APOGEE ELLIPSE S-IVB ENGINE MAIN LOX VALVE FAILS TO CLOSE AT CUTOFF LOSS OF ATTITUDE CONTROL CONFIRMED ACTUATOR HARDOVER LOSS OF ENGINE HYDRAULIC FLUID MISALIGNMENT RATE BETWEEN THE IU AND IMU IS OUTSIDE LIMITS UNACCEPTABLE DIFFERENCES BETWEEN CMC AND IU PLATFORM VELOCITY COMPONENTS OR TOTAL VELOCITY AT INSERTION UNACCEPTABLE DIFFERENCE BETWEEN MSFN AND IU ORBITAL DECISION PARAMETERS

R	ITEM	
	3-14	TLI WILL BE TERMINATED FOR --- A. PITCH OR YAW BODY RATES GREATER THAN 10 DEG./SEC B. ROLL BODY RATE GREATER THAN 20 DEG/SEC C. PITCH OR YAW ATTITUDE DEVIATIONS FROM NOMINAL PROFILES EXCEED 45 DEG. D. OVERBURN OF 6 SECS AND VI (PGNS) EQUALS VI (PAD)
	3-15	TLI WILL BE PERFORMED--- A. A SATURN GUIDANCE REFERENCE FAILURE BY CSM TAKEOVER IN EARTH ORBIT OR DURING TLI. TLI WILL BE PERFORMED BY MANUAL CONTROL AND CUTOFF TECHNIQUES. B. SATURN ACCELEROMETER FAILURES USING IU COMPUTER CONTROL WITH A MANUAL CUTOFF BASED ON TOTAL INERTIAL VELOCITY FROM THE CMC.
	3-16	CSM SEPERATION (WITH 24 SEC RCS ASAP) FROM THE SIVB WILL BE DONE FOR THE FOLLOWING LOSSES OF SIVB ATTITUDE CONTROL. A. SIVB ATTITUDE RATES GREATER THAN OR EQUAL TO 5 DEG/SEC. B. SIVB YAW ATTITUDE GREATER THAN 45 DEG.
		RULES 3-17 THROUGH 3-20 ARE RESERVED.

TD&E

3-21 TD&E WILL NOT BE PERFORMED FOR---

A. PILOTS EVALUATION OF RATES AND ATTITUDES, AND SLA CONFIGURATION NOT ACCEPTABLE.

B. THE SLV IS NO-GO FOR---

1. VIOLATION OF S-IVB BULKHEAD DELTA P LIMITS
2. LOX TANK PRESSURE GREATER THAN 50 PSI

3-22 THE FOLLOWING ACTIONS WILL BE TAKEN FOR LOSS OF SATURN ATTITUDE CONTROL CAPABILITY---

	BSE ACTION	CREW ACTION
A. TLI CUTOFF TO S/C SEPARATION FROM BOOSTER	1. RECOMMEND SPACECRAFT GUIDANCE TAKE OVER	TAKEOVER CONTROL OF SATURN.
	2. IF SPACECRAFT SEPARATION OCCURS BEFORE 15 MINUTES, COMMAND TD&E MANEUVER INHIBIT.	1. IF SUCCESSFUL, MANEUVER TO SEPARATION ATTITUDE AND SEPARATE. CREW DISCRETION FOR DOCKING AND LM EXTRACTION. EVASIVE MANEUVER WILL BE ACCOMPLISHED BY S/C.
	3. DO NOT COMMAND YAW MANEUVER OR EVASIVE BURN INITIATE (TB8 INITIATE).	2. IF UNSUCCESSFUL - SEPARATE FROM BOOSTER IMMEDIATELY. CREW DISCRETION FOR DOCKING AND LM EJECTION. EVASIVE MANEUVER WILL BE ACCOMPLISHED BY S/C.
	4. COMMAND NON-PROPULSIVE S-IVB SAFEING.	
B. S/C SEPARATION TO INITIATE (TB8 INITIATE).	BSE ACTION	
	1. IF BEFORE YAW MANEUVER, DO NOT COMMAND YAW MANEUVER	1. CREW DISCRETION FOR DOCKING AND LM EJECTION.
	2. DO NOT COMMAND EVASIVE BURN (TB8 INITIATE).	2. EVASIVE MANEUVER WILL BE ACCOMPLISHED BY S/C.
	3. COMMAND NON-PROPULSIVE S-IVB SAFEING.	
C. AFTER EVASIVE BURN INITIATE (TB8 INITIATE).	BSE ACTION	CREW ACTION
	1. TERMINATE ALL FUNCTIONS INCLUDING LOX DUMP, ULLAGE ENGINE BURNS, AND LH2 CONTINUOUS VENT. ONBOARD PROGRAM WILL ACCOMPLISH NON-PROPULSIVE SAFEING.	

RULE NUMBERS 3-23 THROUGH 3-29 ARE RESERVED.

R | ITEM

' TRANSLUNAR COAST '

3-30 THE G+N WILL BE THE PRIMARY MODE OF EXECUTING TRANSLUNAR MCC.

3-31 MIDCOURSE CORRECTION NOMINAL EXECUTION POINTS WILL BE AT THE FOLLOWING---

A. TLI C/O + 9 HRS

B. TLI C/O + 28 HRS

C. LOI - 22 HRS

D. LOI - 5 HRS

3-32 DURING THE LOI BURN, THE FLIGHT CREW WILL TAKE THE FOLLOWING ACTION---

LOI ABORT MODES

MODE	TIME	DELTA VM	TYPE ABORT
I	0 TO 33 SEC	0 TO 238	•DPS 2-HR DIRECT ABORT
	33 SEC TO 1+15	238 TO 545	•DPS 30 MIN DIRECT ABORT
	1+15 TO 1+39	545 TO 725	•DPS TO DEPLETION 30 MIN DIRECT ABORT FOLLOWED BY AN APS BURN 2 HRS LATER
II	1+39 TO 2+41	725 TO 1202	•DPS 2 IMPULSE CIRCUMLUNAR ABORT
III	2+41 TO 6+07	1202 TO 2986	•EXCUTE TEI (SPS OR DPS) AT NEXT OPPORTUNITY OR INITIATE ALTERNATE MISSION

A. ALL ABORT MANEUVERS ARE MCC TARGETED EXCEPT THE DPS 30 MIN ABORT IS TAKEN FROM THE CREW CHART.

B. CONTROL LIMITS APPLY AS FOLLOWS---

LOI DELTA T	LOI DELTA V	LIMITS
0 TO 33 SEC	0 TO 238	TIGHT
33 SEC TO 3+ 20	238 TO 1513	LOOSE
3+ 20 TO C/O	1513 TO 2986	TIGHT

NOTE

IF ANY BALL VALVE CLOSES PREMATURELY, SHUTDOWN GOOD BANK 10 SEC PRIOR TO CUTOFF FOR VERIFICATION OF THE FAILURE

RULES 3-33 THROUGH 3-37 ARE RESERVED.

R	ITEM	
		LUNAR ORBIT
	3-38	PRIOR TO UNDOCKING, CSM MANEUVERS WILL BE SCHEDULED WHEN REQUIRED TO CORRECT THE FOLLOWING SITUATIONS--- A. MISS DISTANCE OVER THE LLS GREATER THAN 0.5 DEG OUT OF PLANE. B. DEVIATION IN APPROACH AZIMUTH GREATER THAN +/- 2 DEG. FROM THE NOMINAL. C. CURRENT PERICYNTHION ALTITUDE LESS THAN 30,000 FT. D. PREDICTED ALTITUDE AT PDI IGNITION LESS THAN 30,000 FT. OR GREATER THAN 70,000 FT. (PREDICTIONS WILL BE BIASED USING EXPECTED/CALCULATED WORST CASE PROPOGATION ERRORS). NOTE WHEN POSSIBLE ANY REQUIRED MANEUVERS(S) WOULD BE SCHEDULED SHORTLY AFTER CREW WAKE-UP ON PDI DAY.
	3-39	DOI RESIDUALS--- A. TRIM PGNS X-AXIS TO WITHIN +/- 1 FPS. 1. IF A DOI OVERBURN RESULTS IN A RESIDUAL GREATER THAN 2.2 FPS, BUT LESS THAN 10 FPS, PITCH 180 DEGREES AND TRIM TO 1 FPS USING +X SM-RCS THRUSTERS. 2. RESIDUALS GREATER THAN 10 FPS WILL BE TRIMMED USING SPS. 3. UNDERBURNS WILL NOT BE TRIMMED. B. IF EITHER THE PNGS OR EMS HAS OBVIOUSLY MALFUNCTIONED, THE RESIDUALS INDICATED BY THE REMAINING SYSTEM WILL BE TRIMMED AND MCC WILL RELAY A STAY/NO STAY DECISION BASED ON MSFN DATA ANALYSIS.
	3-40	AT AOS AFTER DOI, THE REQUIREMENT FOR THE BAILOUT MANEUVER WILL BE DETERMINED BY EVALUATION OF THE THREE TRAJECTORY MONITORING SOURCES. THESE SOURCES - PGNS, EMS, AND MSFN - WILL BE EXAMINED WITH THE FOLLOWING CRITERIA--- A. IF MSFN RADAR DATA IS VALID AND REASONABLE, A STAY VOTE FROM MSFN IS REQUIRED TO REMAIN IN THE LOW ORBIT. B. IF MSFN RADAR DATA IS INVALID OR UNAVAILABLE, THE FOLLOWING CRITERIA APPLIES--- 1. IF THE PGNS AND EMS ARE AVAILABLE, BOTH SOURCES MUST INDICATE STAY TO REMAIN IN THE LOW ORBIT. 2. IF ONLY THE PGNS IS AVAILABLE, IT MUST INDICATE STAY TO REMAIN IN THE LOW ORBIT. 3. IF THE EMS RESIDUAL IS TRIMMED DUE TO CREW OBSERVATION OF A PGNS MALFUNCTION, THE BAIL OUT MANEUVER WILL BE EXECUTED AT THE NOMINAL TIME. NOTE--- 1. THE EMS VOTE IS NO STAY IF THE EMS INDICATES A 6 FPS OVERSPEED AFTER TRIMMING THE PGNS. 2. THE MSFN VOTE IS NO STAY IF THE INCOMING RADAR DATA INDICATES A CLOSEST APPROACH ALTITUDE OF EQUAL TO OR LESS THAN 1.0 N. MI. ABOVE THE LUNAR TERRAIN. THIS ALTITUDE CORRESPONDS TO A PERICYNTHION ALTITUDE OF 3.6 N. MI. AND DOPPLER RESIDUALS AT AOS OF -32 CYCLES PER SECOND.

R	ITEM	
	3-41	THE FOLLOWING RNDZ/RESCUE OPTIONS WILL BE UTILIZED AS NECESSARY FOR FAILURES REQUIRING TERMINATION OF LUNAR LANDING---
	A.	FOR FAILURES FROM CIRCULARIZATION TO CIRCULARIZATION PLUS 1 HR, EXECUTE THE PDI ZERO ABORT SEQUENCE.DOCKING IN ABORT 31/4 HRS.
	B.	FOR FAILURES FROM CIRCULARIZATION PLUS 1 HR TO PDI, EXECUTE THE NO PDI + 12 ABORT SEQUENCE. DOCKING IN ABOUT 5 1/4 HRS.
	C.	ABORT DURING POWERED DESCENT WILL INSERT THE LM INTO ORBIT UTILIZING THE ONBOARD VARIABLE ABORT TARGETING. FOR ABORTS DURING THE FIRST 6 MIN, DOCKING SHOULD OCCUR WITHIN 5 1/4 HRS, FOR ABORTS AFTER 6 MIN. DOCKING WILL OCCUR WITHIN 3 1/4 HRS.
	D.	FOR COMPLETE LM FAILURES PRIOR TO PDI, THE CSM WILL EXECUTE A FIVE IMPULSE RESCUE WITH DOCKING IN ABORT 7 1/4 HRS FROM PDI.
		RULE NUMBERS 3-42 THROUGH 3-48 ARE RESERVED

R	ITEM	
		' POWERED DESCENT PHASE '
	3-49	PDI IGNITION
		THE FOLLOWING ACTION WILL BE TAKEN---
		1. AUTO ULLAGE GOOD
		- IF NO AUTO DPS IGN, FLIGHT CREW PERFORM MANUAL DPS IGNITION
		2. NO AUTO ULLAGE
		-FLIGHT CREW BACK UP THE ULLAGE MANEUVER
		-IF NO AUTO DPS IGN FLIGHT CREW WILL NO-GO PDI
	3-50	PDI TO LO GATE
		POWERED DESCENT WILL BE ABORTED FOR THE FOLLOWING---
		A. LR DATA IS REQUIRED FOR LANDING - NO LR DATA BY 10 K FT - ABORT.
		1. LR CONVERGENCE (ALTITUDE ONLY) - DATA NOT BEING ACCEPTED OR CONVERGING FOLLOWING LOCKON FOR 60 SECONDS - ABORT.
		2. LR DATA ACCEPTED AND CONVERGED CONTINOUS TO P-64 - CONTINUE MISSION IF LOSS OF LOCK OCCURS IN P-64.
		3. LR DATA ACCEPTED AND CONVERGED WITH SUBSEQUENT DROPOUT - CONTINUE TO P-64.
		(A) LANDING RADAR REGAINED IN P-64.
		(1) DELTA H LESS THAN 1000 FT BETWEEN PGNS AND LR - CONTINUE MISSION.
		(2) DELTA H GREATER THAN 1000 FT BETWEEN PGNS AND LR - ATTEMPT MANUAL LANDING IN AGS.
		(B) LR NOT REGAINED IN P-64 - ABORT.
		4. LATE LR LOCKON WITH DATA BEING INCORPORATED AND CONVERGING - CONTINUE TO P-64.
		(A) DELTA H LESS THAN 1000 FT BETWEEN PGNS AND LR - CONTINUE MISSION.
		(B) DELTA H GREATER THAN 1000 FT BETWEEN PGNS AND LR - ATTEMPT MANUAL LANDING IN AGS.
		B. PGNS ALTITUDE LESS THAN 22,000 FEET AND PNGS NAVIGATION ERRORS, CONFIRMED BY MSFN OR DOPPLER RESIDUALS, THAT CAUSE THE AGS-PGNS RADIAL VELOCITY DIFFERENCE TO EXCEED MINUS 10 FPS, PRIOR TO LANDING RADAR ALTITUDE INCORPORATION AND CONVERGENCE (A MINUS VELOCITY DIFFERENCE INDICATES THAT THE AGS TRAJECTORY IS LOWER THAN THE PNGS TRAJECTORY).
		C. PNGS NAVIGATION ERRORS, CONFIRMED BY MSFN OR DOPPLER RESIDUALS, THAT RESULT IN THE FOLLOWING AGS-PNGS VELOCITY DIFFERENCES---
		DELTA X DOT (DOWNRANGE) GREATER THAN +/- 45 FPS DELTA Y DOT (CROSSRANGE) GREATER THAN +/- 90 FPS DELTA Z DOT (RADIAL) GREATER THAN +/- 35 FPS
		D. PGNS ALTITUDE LESS THAN 18,000 FEET AND PNGS NAVIGATION ERRORS, CONFIRMED BY DOPPLER BUT NOT BY AGS, CAUSE THE MSFN-PGNS RADIAL VELOCITY DIFFERENCE TO EXCEED MINUS 20 FPS PRIOR TO LANDING RADAR ALTITUDE INCORPORATION AND CONVERGENCE.
		E. PNGS NAVIGATION ERRORS CONFIRMED BY DOPPLER RESIDUALS BUT NOT BY AGS, THAT RESULT IN THE FOLLOWING MSFN-PNGS VELOCITY DIFFERENCES---
		DELTA Y DOT (CROSSRANGE) GREATER THAN +/- 200 FPS. DELTA Z DOT (RADIAL) GREATER THAN +/- 35 FPS.
		NOTE---RULES C AND E ARE INDEPENDENT OF ANY TYPE OF LANDING RADAR UPDATE. FOR RULES B AND C, SWITCHOVER TO AGS WILL BE PERFORMED.

R	ITEM	
		F. COMMANDED THRUST INCREASING PRIOR TO THROTTLE DOWN OR P63 TGO=80 SEC.
		G. NO LANDING SITE VISIBILITY BY P64 PLUS 60 SEC.
		H. NO THROTTLE RECOVERY BY P63/P64 PROGRAM SWITCH PLUS 15 SEC.
		I. FAILURE TO ACHIEVE FTP BY NOMINAL TIG +31 SEC. (ABORT AT GTC DIVERGENCE).
		J. FAILURE TO ENTER P64 WHEN TGO EQUALS 60 SECONDS.
		K. THE FOLLOWING PNGS ALARMS---20105,00214, 20430,20607,21103,01107, 21204,21302,21501,00402 (CONTINUING).
		L. VOLATION OF THE TIME BIASED DPS ABORT BOUNDARY
		M. NO THROTTLE RECOVERY WITHIN 40 SEC AFTER GTC EQUALS 57 PERCENT
	3-51	HIGH GATE TO TD
		AN ABORT WILL NOT BE PERFORMED FOR A PNGS FAILURE AFTER A PNGS INDICATION THAT THE HIGH GATE TARGETING CONDITIONS HAVE BEEN ACHIEVED.
		RULE NUMBERS 3-52 AND 3-53 ARE RESERVED.

R	ITEM	
		' EVA PHASE '
	3-54	GENERAL FOR ANY MALFUNCTION ON A SCIENTIFIC TASK, A MAXIMUM OF 10 MINUTES WILL BE SPENT ON THE CONTINGENCY PROCEDURE BEFORE THE TASK IS ABANDONED WITH THE FOLLOWING EXCEPTIONS--- A. RTG FUELING-- UP TO 20 MUNUTES WILL BE ALLOWED IN EXERCISING RTG FUELING CONTINGENCY PROCEDURES. B. ALSEP PACKAGE 1 TO PACKAGE 2 CABLE CONNECTION-- UP TO 20 MINUTES WILL BE ALLOWED FOR MAKING THE CABLE CONNECTION. C. ALSEP ANTENNA-- UP TO 30 MINUTES WILL BE ALLOWED FOR ANTENNA ERECTION AND ALIGNMENT.
	3-55	FOR EVA TERMINATION OR OTHER INTERRUPTIONS DURING ALSEP DEPLOYMENT, THE FOLLOWING PREFERRED DEPLOYMENT INTERRUPTION POINTS WILL BE OBSERVED IF PERMITTED BY CREW SAFETY CONSIDERATIONS--- A. ANY POINT PRIOR TO DEFUELING THE FUEL CASK. B. AFTER FUELING THE RTG, THE ALSEP SHOULD BE CARRIED TO THE DEPLOYMENT SITE, PACKAGE NO. 1 SHOULD BE EMPLACED, THE SUBPALLET SHOULD BE REMOVED FROM PACKAGE NO. 2, AND THE RTG CABLE SHOULD BE INTERCONNECTED. C. DEPLOYMENT MAY BE INTERRUPTED ANY POINT THEREAFTER.
	3-56	IF ALSEP DEPLOYMENT IS NOT COMPLETED DURING EVA-1 AND THE TASK IS NOT ABANDONED, THE DEPLOYMENT WILL BE COMPLETED DURING EVA-2.

R	ITEM	
	3-57	CAMERA FRAME COUNTS WILL BE OBTAINED AT A SUFFICIENT FREQUENCY (APPROXIMATELY 30-MINUTE INERVALS) TO ENABLE ACCURATE CORRELATION OF SAMPLES AND PHOTOS FOR SAMPLE ORIENTATION.
	3-58	LUNAR SURFACE OPERATIONS IN ESTABLISHING THE OPERATIONAL EVA PLAN, THE TRAVERSE PLANS PREPARED BEFORE LAUNCH WILL BE USED AS BASELINES AND MODIFIED AS NECESSARY TO ACCOMMODATE THE ACTUAL LANDING POINT, RADIUS OF OPERATIONS AND TIMELINE CONSTRAINTS, AND SPECIFICALLY INTERESTING FEATURES VISABLE TO THE CREW.
	3-59	THE OPERATIONAL EVA PLAN WILL BE CONSTRAINED TO A MAXIMUM DURATION OF 4 HOURS AND 15 MIN. A MAXIMUM BSLSS OPERATIONAL RADIUS OF 3 KM AND A MAXIMUM OPS OPERATIONAL RADIUS OF 1 KM WILL BE APPLIED. EXTENSIONS, DETERMINED DURING THE EVA BASED ON CONSUMABLES USAGE RATES AND CREW COMFORT, TO A MAXIMUM OF APPROXIMATELY 5 HRS MAY BE IMPLEMENTED. PROBABLE EXTENSION POINTS WILL BE AFTER ALSEP DEPLOYMENT (FOR EVA 1) AND AT TRAVERSE SITES FARTHEST FROM THE LM (FOR EVA 2).
	3-60	THE CREW WILL HAVE PRIME RESPONSIBILITY FOR--- A. SELECTION OF SAMPLES TO BE COLLECTED. B. DECISIONS TO DEPART FROM THE OPERATIONAL EVA PLAN TO INVESTIGATE UNEXPECTED OR UNUSUAL FEATURES. C. ON THE SPOT DETERMINATION OF BEST TRAVERSE PATH TO PROVIDE MOBILITY EASE. D. ON THE SPOT DETERMINATION OF ACCESSIBILITY OF FEATURES OF INTEREST. E. SELECTION OF A SUITABLE LOCATION FOR PERFORMING EVA COMMUNICATIONS TEST. F. SELECTION OF APPROPRIATE PLACES FOR MET/SOIL INTERACTION EVALUATION. G. SELECTION OF APPROPRIATE PLACES FOR LUNAR SURFACE CLOSEUP CAMERA PHOTOGRAPHY.

R	ITEM	
	3-61	GROUND INITIATED CHANGES TO THE OPERATIONAL EVA PLAN WILL BE LIMITED. THE FOLLOWING CONDITIONS WILL BE DEEMED REASONABLE CAUSES FOR GROUND INITIATED CHANGES. A. UNEXPECTED FEATURES OF SIGNIFICANT SCIENTIFIC INTEREST REPORTED BY THE CREW. B. CONSUMABLES CONSUMPTION RATES OR OTHER CONDITIONS NECESSITATE CURTAILMENT OR TERMINATION OF EVA. C. CONSUMABLES CONSUMPTION RATES PERMIT EXTENSION OF EVA. D. ENCOUNTERED OR PROJECTED INABILITY TO ACCOMPLISH SPECIFIC TASKS IN THE OPERATIONAL EVA PLAN.
	3-62	ONE-MAN EVA'S WILL BE ALLOWED FOR COMPLETION OF THE FOLLOWING ACTIVITIES WITHIN TIME CONSTRAINTS, IN PRIORITY ORDER--- A. ABORTED EVA TERMINATION TASKS. B. CONTINGENCY SAMPLE COLLECTION. C. ALSEP DEPLOYMENT AND ACTIVATION. D. COLLECTING SELECTED SAMPLES. E. LRRR DEPLOYMENT. F. COMPREHENSIVE SAMPLE COLLECTION. G. OTHER TASKS WITHIN THE CAPABILITY OF A SINGLE CREWMAN.
	3-63	FOR ONE-MAN EVA'S THE RADIUS OF OPERATIONS WILL BE LIMITED TO 300 METERS FROM THE LM.
	3-64	FOR SITUATIONS REQUIRING DELETIONS OF TASKS TO MAKE UP TIMELINE LAGS, THE FOLLOWING TASKS IN THE LISTED ORDER WILL BE CONSIDERED FOR DELETION--- TBD
	3-65	THE COLOR TV CAMERA WILL NOT BE POINTED SUCH THAT THE SUN WILL BE IN THE FIELD OF VIEW. THE CAMERA MAY BE POINTED NEAR THE SUN, HOWEVER, IF OBJECTIONABLE FLARE OCCURS, THE GROUND WILL REQUEST THE CAMERA TO BE MOVED.
	3-66	THE GROUND WILL MONITOR THE TV PICTURE AND RECOMMEND CAMERA MOVEMENT TO PREVENT IRREVERSIBLE VIDICON TUBE BURNS FROM REFLECTIVE OBJECTS.
	3-67	BETWEEN EVA'S THE TV CAMERA WILL BE LOCATED IN THE SUN AND OPERATING TO MINIMIZE THE POSSIBILITY OF FREEZING.
	3-68	DELETED
	3-69	IF THE THERMAL CONSTRAINTS ON THE CAMERA OPERATING TIME IN THE MESA ARE VIOLATED. THE GROUND WILL REQUEST THE CAMERA BE TURNED OFF.
	3-70	DELETED
	3-71	WHEN A BRIGHT OBJECT WITH A CONTRASTING DARK BACKGROUND IS IN THE FIELD OF VIEW THE GROUND WILL RECOMMEND AN ALC SWITCH SETTING TO GET THE BEST PICTURE. THE ALC-PEAK WILL GIVE THE BEST PICTURE OF THE BRIGHT OBJECT AND THE ALC-AVERAGE WILL GIVE THE BEST PICTURE OF THE DARK BACKGROUND. RULES 3-72 THROUGH 3-79 ARE RESERVED.

R	ITEM	
		' ASCENT '
	3-80	ASCENT
		A. GUIDANCE SWITCHOVER TO AGS WILL BE PERFORMED FOR ---
		1. THE FOLLOWING PGNS ALARMS---20105,00214, 20430,20607, 21103,01107, 21204,21302, AND 21501.
		2. PGNS NAVIGATION ERRORS, DURING ASCENT OR FOLLOWING DESCENT ABORT, THAT RESULT IN ANY OF THE FOLLOWING CONDITIONS---
		(A) AGS PREDICTED HP AT INSERTION LESS THAN 40,000 FT
		(B) AGS PREDICTED HA AT INSERTION GREATER THAN TARGET VALUE PLUS 40 NAUTICAL MILES.
		(C) AGS PREDICTED INSERTION WEDGE ANGLES GREATER THAN 1.0 DEG. (DESCENT ABORT CASE OR COELLIPTIC SEQ RNDZ) GREATER THAN 0.5 DEG. (SHORT RNDZ)
		3. CONFIRMED PNGS NAVIGATION ERRORS THAT RESULT IN THE FOLLOWING MSFN PNGS VELOCITY DIFFERENCES
		(A) DELTA VX (DOWN RANGE) GREATER THAN +/-24FPS
		(B) DELTA VY (CROSS RANGE) GREATER THAN +/-90FPS (COELLIPTIC SEQ. RNDZ) GREATER THAN +/-45FPS (SHORT RNDZ)
		(C) DELTA VZ (RADIAL) GREATER THAN +/-37FPS
		B. THE GROUND WILL NOT REQUEST SWITCHOVER AFTER AGS TGO LESS THAN 30 SECONDS.
		C. DURING ASCENT, THE AGS WILL BE DECLARED NO-GO IF CONFIRMED AGS NAVIGATION ERRORS RESULT IN---
		1. PGNS PREDICTED INSERTION HP LESS THAN 30,000 FT.
		2. PGNS PREDICTED INSERTION HA GREATER THAN TARGET VALUE PLUS 40 NM.
		3. PGNS PREDICTED INSERTION WEDGE ANGLE GREATER THAN 1.0 DEGREE. (COELLIPTIC SEQ. RNDZ) GREATER THAN 0.5 DEG (SHORT RNDZ)
	3-81	REQUIREMENTS TO COMMIT TO THE SHORT RNDZ
		A. PRIOR TO L/O THE FOLLOWING IS REQUIRED.
		1. ONE OPERATIONAL LM GUIDANCE SYSTEM
		2. WEDGE ANGLE AT LIFT-OFF LESS THAN .5 DEG.
		3. LM RCS REDLINES MUST NOT HAVE BEEN VIOLATED
		4. NO VIOLATION OF THE NAVIGATION REQUIREMENTS (REFERENCE MATRIX P.3-15
		B. AT INSERTION (PRE-TWEAK) THE FOLLOWING IS REQUIRED
		1. LM 3 AXIS ATTITUDE CONTROL
		2. LM X AXIS TRANSLATION CAPABILITY
		3. LM RCS DELTA V FOR TWEAK AND ATTITUDE CONTROL
		4. TWEAK DELTA V LESS THAN 60 FPS
		5. POST TWEAK HP GREATER THAN 5 N. MI.
		6. NO VIOLATION OR THE NAVIGATION REQUIREMENTS (REFERENCE MATRIX P.3-15
		(NOTE: WITH THE EXCEPTION OF COMPUTERS, NO ONBOARD NAVIGATION SYSTEMS ARE VERIFIED AFTER LIFT-OFF)

ACCEPTABLE COMBINATIONS OF G&N SYSTEMS NEEDED FOR SHORT RDZ

COMPUTERS (G+N)			RR			VHF			OPTICS/LITES					
LGC	AEA	CMC	RR	TAPE-METER /RR	LGC/ RR	VHF	VHF/ CMC	VHF/ EMS	LM COAS	CSM LITE	CSM COAS	LM LITE	SXT	ACCEPTABLE COMBINATIONS OF NAV TECH
R_1	R_2		R_1		R_1	R_2		R_2	R_2	R_2				1. PGNCS+RR 2. AGS+VHF
R_1		R_2	R_1		R_1							R_2	R_2	1. PGNCS+RR 2. GNCS+SXT
R_1		R_2	R_1		R_1	R_2	R_2				(R_2)	REFLECT-ED LIGHT	(R_2)	1. PGNCS+RR 2. GNCS+VHF
	R_1	R_2	R_1	R_1								R_2	R_2	1. AGS+RR 2. GNCS+SXT
	R_1	R_2	R_1	R_1		R_2	R_2				(R_2)	REFLECT-ED LIGHT	(R_2)	1. AGS+RR 2. GNCS+VHF
	R_1	R_2				R_1		R_1	R_1	R_1		R_2	R_2	1. AGS+VHF 2. GNCS+SXT

1. R indicates that the system is required for the NAV technique to be available.
2. The numbers indicate which technique the system is required for.
3. The acceptable combinations of NAV techniques maintain two independent NAV methods.
4. Sextant or COAS is adequate for ( ) cases.

INSTRUCTION: Mark through the failed systems (columns); then mark through the cases (rows) containing the failed systems. If one or more cases remain, short RDZ is GO.

R	ITEM	
		TRANSEARTH COAST
	3-82	TRANSEARTH MCC WILL BE TARGETED TO ACHIEVE ENTRY CONDITIONS AS FOLLOWS--- A. IF VEI GREATER THAN 31000 FPS OR G&N NO GO, USE STEEP TARGET LINE. B. IF VEI LESS THAN 31000 FPS AND G&N GO, USE SHALLOW TARGET LINE. C. TRANSEARTH MIDCOURSE CORRECTON NOMINAL EXECUTION POINTS WILL BE AT THE FOLLOWING--- 1. TEI + 15 HRS 2. EI - 22 HRS 3. EI - 3 HRS
	3-83	TRANSEARTH MCC PHILOSOPHY A. TEC MCC WILL NOT USE LANDING POINT CONTROL UNLESS THE LANDING POINT IS UNACCEPTABLE. B. IF GAMMA EI IS OUTSIDE THE ENTRY CORRIDOR, EXECUTE MCC ASAP (EXCEPT---MCC 5) C. MCC GREATER THAN MINIMUM IMPULSE CAPABILITY WILL USE THE SPS IF PRACTICAL.
	3-84	RESERVED

R	ITEM	
		MANEUVERS
	3-85	THE FOLLOWING GUIDELINES WILL APPLY TO LM MANEUVERS--- 1. TRIMMING. A. DESCENT ABORTS/ASCENT - REAL TIME CALLOUT. B. ALL RENDEZVOUS MANEUVERS WILL BE NULLED. C. DOCKED DPS MANEUVERS WILL NOT BE TRIMMED. 2. ALTERNATE MISSION DOCKED DPS MANEUVERS WILL BE COMPLETED VIA AGS TAKEOVER FOR VIOLATION OF THE FOLLOWING LIMITS--- A. ATTITUDE RATES - 10 DEG./SEC. B. ATTITUDE ERRORS - 10 DEG. C. ATTITUDE EXCURSIONS - 10 DEG. 3. ALTERNATE MISSION DOCKED DPS MANEUVERS WILL BE TERMINATED AFTER VIOLATION OF THESE OVERBURN CRITERIA--- A. DPS LOI - 10 SEC AND DELTA V AGS GREATER THAN 10 FPS. B. DPS TEI - 10 SEC AND DELTA V AGS GREATER THAN 2 FPS. C. DPS LOI ABORTS - 10 SEC AND DELTA V AGS GREATER THAN 2 FPS. NOTE--- A CMC DELTA V OF 2 FPS (OVERSPEED) AND 10 SEC OVERBURN IS ALSO A VALID CUE FOR SHUTDOWN.
	3-86	THE FOLLOWING TABLE, INCLUDING NOTES AND REFERENCES, SUMMARIZES THE TAKEOVER, RESTART, SHUTDOWN, TRIMMING REQUIREMENTS, AND SPS ENGINE LIMITS FOR ALL SPS MANEUVERS.
		RULE NUMBERS 3-87 THROUGH 3-89 ARE RESERVED.

MANEUVER	ENGINE LIMITS		RATES/ERRORS FOR		MANUAL START ACTION	OVERBURN SHUTDOWN CRITERIA	EARLY C/O RESTART CRITERIA	RCS TRIM GUIDELINES
	INHIBIT	TERMINATE	TAKEOVER	ACTION				
MODE III	NONE	ERRATIC ENG	5/5	COMPLETE	START	g	Hp > 40	N/A
MODE IV	NONE	ERRATIC ENG	5/5	COMPLETE	START	g	Hp < 100 IF G&N GO ΔVTG > 60 OR C/O > 6 SEC EARLY	N/A
APOGEE KICK	NONE	ERRATIC ENG	5/5	COMPLETE	START	g	Hp < 100 IF G&N GO ΔVTG > 60 OR C/O > 6 SEC EARLY	N/A
TLC MCC	TIGHT[i]	TIGHT[i]	10/10	TERMINATE	DELAY	1 SEC	NO	X = 0.2[a b]
LOI	TIGHT				START			NO
a. MODE I								
0 TO 33 SEC		TIGHT	10/10	COMPLETE			YES	
33 SEC TO 1 + 15		LOOSE	10/10	COMPLETE			YES	
1 + 15 TO 1 + 39		LOOSE	10/10	COMPLETE			YES	
b. MODE II		LOOSE	10/10	COMPLETE			YES	
c. MODE III								
2 + 41 TO 3 + 20		LOOSE	10/10	COMPLETE			YES	
3 + 20 TO C/O		TIGHT[h]	10/10	COMPLETE		10 SEC	V_{GO} > 50 AND G&N GO	
DOI	TIGHT[i]	TIGHT[i]	10/10	TERMINATE	DELAY	BT	NO	X = 1.0
CIRC	TIGHT	TIGHT	10/10	TERMINATE	DELAY	1 SEC	NO	X = 1.0 Y = 0.2
RESCUE	LOOSE	LOOSE	10/10	COMPLETE	START	1 SEC	ΔV TOGO > 12	ALL = 0.2
LOPC	TIGHT	TIGHT	10/10	TERMINATE	DELAY	1 SEC	NO	NO
TEI (G&N)	NONE	NONE	10/10	COMPLETE	DELAY	2 SEC AND ΔV_C = -40[c]	C/O > 3 SEC EARLY AND ΔV_C > 50[c]	X AND Z = 0.2
TEI (SCS)	NONE	NONE	10/10	COMPLETE	START	2 SEC	ΔV_C > 50 OR C/O > 5 SEC EARLY	NO
TEC MCC								
a. CORRIDOR	LOOSE	LOOSE	10/10	COMPLETE	DELAY	1 SEC AND ΔV_C = 0	NO	X = 0.2
b. IP CONTROL	TIGHT	TIGHT	10/10	TERMINATE	DELAY	1 SEC AND ΔV_C = 0	NO	X AND Z = 0.2
TLC ABORT	TIGHT	LOOSE	10/10	COMPLETE	START	10 SEC AND ΔV_C = -70	C/O > 10 SEC EARLY AND ΔV_C > 70	NO
EARTH DEORB	LOOSE[d]	LOOSE	10/10	COMPLETE	START	1 SEC AND ΔV_C = 0	ΔV TO GO > 30 AND C/O > 3 SEC EARLY[e]	ALL = 0.2

TIGHT LIMITS: Fuel/Ox ΔP > 20 and low P_c; either prop tank press < 160 psi and low P_c; P < 80 or decays 10 psi: inhibit burn for any leak in He or prop tank. 0 < $GN_2A(B)$ < 400 psi: certain burns may be allowed with He tank leak if blowdown ΔV exceeds remaining mission requirements.[f]

LOOSE LIMITS: P_c < 70 psi and other cues; either prop tank < 115 psi and low P_c; erratic engine (popping, vibration, etc.)[f]

NOTES:

a. MCC_4: Trim X to 1.0 fps

b. Trim all MCC (except MCC_4) only if X ≤ 2 fps

c. See Rule 5-131

d. Both prop tank pressures ≥ 140; one GN_2 tank press ≥ 400 if SM-RCS deorbit is available.

e. See Rule 5-27

f. Some limits may be downgraded if warranted by mission circumstance.

g. See Rule 5-3

h. If indication of ball valve fail, shut down good bank 10 sec prior to nominal cutoff to verify indication.

i. If indication of ball valve failure inhibit burn, or if thrusting, shut down good bank to verify failure. If thrusting continues, re-enable good bank. For DOI apply only when bringing second bank on line.

SATURN LAUNCH VEHICLE GO/NO-GO CRITERIA
(11/1/70)

GO/NO-GO ITEM CONDITION	LAUNCH → EARTH PARKING ORBIT				
	ABORT/SEPARATION	S-II/S-IVB EARLY STAGE	GUIDANCE TAKEOVER	RESTART/TLI INHIBIT	RESTART/TLI TERMINATE
S-IC LOSS OF THRUST (2 OR MORE ENG)	PRIOR TO TBI + 2:00 - ABORT	NO			
Q BALL + 5° ATT ERROR	MANUAL ABORT				
4°/SEC P AND Y, 20°/SEC R	AUTO ABORT TO 2 + 00				
10°/SEC P AND Y, 20°/SEC R	MANUAL ABORT AFTER 2 + 00				TLI TERMINATE
IU LOSS OF ATTITUDE CONTROL	ABORT (LAUNCH)	NO	ATTEMPT S/C CONTROL TB5 AND TB7 TO TB7 + 15 MIN	DURING TB6 TO TB6 + 9 MIN 20 SEC	TLI TERM DURING BURN CREW OPTION AFTER TB7 + 15
INERTIAL ATTITUDE REFERENCE FAIL	← LAUNCH, EPO TLI →				
S-II LOSS OF THRUST (2 ENG).		FROM S-IVB TO COI TILL TB3 + 4 MIN 40 SEC			
LOSS OF THRUST (3 OR MORE ENG) ABORT IF PRIOR TO S-IVB TO COI	ABORT	AFTER S-IVB TO COI			
ACTUATOR HARDOVER INBOARD	PRIOR TO S-IVB TO COI - ABORT	AFTER S-IVB TO COI AND BEFORE S-II C/O MINUS 30 SEC			
2ND PLANE SEPARATION FAIL	BEFORE TB3 + 66 SEC - ABORT				
S-IVB LOSS OF THRUST	PRIOR TO EPO - SEPARATE				← →
LOSS OF HYDRAULIC FLUID PRIOR TO START	INHIBIT START			INHIBIT TLI DURING TB5 AND TB6	
COLD HE FAIL OPEN	ABORT BEFORE TWR JETT	AFTER TWR JETT			
INSUFFICIENT PROPELLANT				INHIBIT RESTART	← →
LOX VLV FAILS TO CLOSE AT 1ST C/O				INHIBIT RESTART	
DESTRUCT SYSTEM ARMS INADVERTANTLY	SEP TO 7000 FT MINIMUM				
FU/OX BULKHEAD ΔP EXCEEDS LIMITS	← -26 OR + 36 PSID (ANY TIME)	SEP TO 7000 FT MINIMUM →		← -26 OR + 36 PSID (ANY TIME)	SEP TO 7000 FT MINIMUM →
START BOTTLE PRESS OUTSIDE RESTART LIMITS	SEP > 1800 PSIA			SEP > 1800 PSIA	
LOX CHILLDOWN FAIL				FOR LOX LEAD > 20 SEC - INHIBIT	
S-IVB ACTUATOR HARDOVER	NO START			BEFORE TB6 + 9M 10S (AUX PUMP OP)	

LEGEND: NO REQUIREMENT

CSM EECOM GO CRITERIA
11/1/70

	EARTH ORBIT			TLC						POWERED DESCENT		LUNAR STAY		LUNAR ORBIT (POST RNDZ)	POST DOCK
	CONT BOOST	CONT E.O.	TLI	TD & E	CONT TLC	NFR/LOI	CONT L.O./DOI	UNDOCK AND SEP	CIRC	PDI	PDI TO T/D	PAST T_1	PAST T_3 & SUBS		LM JETT
ECS															
CABIN INTEGRITY	←(7)CABIN INTEGRITY→				←		CABIN INTEGRITY			(2)→			←CABIN INTEGRITY→		
NO FIRE OR SMOKE IN CABIN	←NO F OR S IN CABIN→				←		NO FIRE OR SMOKE IN CABIN			(2)→			←NO F OR S IN CAB→		
NO O_2 MANIFOLD LEAKS	←(7*)NO O_2 LEAKS→				←		NO O_2 MANIFOLD LEAKS→							NO O_2 MANIF 2 LEAK	
MAIN O_2 REGULATORS	←(7*)1 OF 2→		BOTH (3)		←		1 OF 2→							1 OF 2	
ECS COOLANT LOOPS		1 OF 2 (5)	BOTH		←BOTH→		←PRIMARY			(2)→			1 OF 2 (5)	PRIMARY	
ECS RADIATORS		1 OF 2 (5)	BOTH		←BOTH→		←(1)-(1)-PRIMARY-(1)			(1)→			1 OF 2 (5)	PRIMARY (1)	
ECS GLYCOL EVAPS															
SUIT INTEGRITY	SI (7*)							S:							
NO GLYCOL LEAK		←NO LEAK→			←		NO GLYCOL LEAK			→			←NO GLY LEAK→		
NO EXCESS CAB HUMIDITY		←NO HUMID→			←		NO EXCESSIVE CABIN HUMIDITY			(2)→			←NO HUMID→		
POTABLE H_2O TANK		POT												POT	
WASTE H_2O TANK															
SUIT COMPRESSORS	←(7*)1 OF 2 (12)	BOTH			←		1 OF 2→	(12)		(12)(2)→			←(12)	1 OF 2 (12)	(12)→
SUIT CIRCUIT	←(7*)	SUIT CIRCUIT→			←		SUIT CIRCUIT			(2)→			←SUIT CIRCUIT→		
OVBD DUMPS		←1 OF 2→			←1 OF 2→									←1 OF 2	
CRYO															
O_2 TANKS		1 OF 3	ALL		←(10)	(10)	(10) ALL	(10)	(10)	(10)→			←(10)	ALL	2 OF 3
H_2 TANKS		1 OF 2	BOTH		←		BOTH			→			←BOTH→		1 OF 2
EPS															
FUEL CELLS	1 OR 0	2 OF 3	ALL		←(6)	(6)	(6) ALL	(6)	(6)	(6)→			←(6)	ALL (6)	2 OF 3 (11)
AUX BATTERIES	1 OR 0														TBD
ENTRY BATTERIES	1 + 1 3	2 OF 3	ALL		←(6)	(6)	(6) ALL	(6)	(6)	(6)→			←(6)	ALL (6)	
MAIN BUSES	1 OF 2	←BOTH→			←		BOTH			(2)→			←BOTH→		
BATTERY BUSES	1 OF 2	←BOTH→			←		BOTH			(2)→			←BOTH→		
AC BUSES	1 OF 2 (9)	←BOTH→			←		BOTH			(2)→			←BOTH→		
BAT RELAY BUSES		←BATT RELAY BUS→			←BAT RELAY BUS					→			←BAT RELAY BUS→		
INVERTERS	1 OF 3 (9)	←2 OF 3→			←		2 OF 3			(2)→			←2 OF 3→		
AC ΦA (1 AND 2)	1 OF 2	←BOTH→			←		BOTH			(2)→			←BOTH→		
DOCKING															
DOCKING LATCHES						9 OF 12									
GN_2 BOTTLES								2 OF 4 (8)							
SEQ															
SMJC NOT ACTIVATED		←(4) SMJC NOT ACT (4)→			←(4) SMJC NOT ACT (4)→										
SEQUENTIAL SYSTEMS		←BOTH→			←BOTH→										

COLUMN NOT APPLICABLE FOR APOLLO 0 14

(1) BASED ON AMOUNT OF WATER AVAILABLE, CONSIDERATION WILL BE GIVEN TO CONTINUING THE MISSION WITH SECONDARY RADIATORS AND PRIMARY EVAPORATORS

(2) LM DESCENT STAGE WILL BE RETAINED FOR TEI IF CONDITION NOT MET

(3) IF ONE MAIN REG HAS FAILED OPEN AND THE OTHER IS FUNCTIONING NORMALLY, TLI WILL BE PERFORMED

(4) NO REQUIREMENT IF SOURCE OF ACTIVATION CAN BE ISOLATED

(5) MUST HAVE EITHER PRIMARY OR SECONDARY SYSTEM COMPOSED OF FUNCTIONING LOOP AND CORRESPONDING RADIATORS

(6) BASED ON FAILURE MODE, CONSIDERATION WILL BE GIVEN TO CONTINUING WITH TWO REMAINING

(7) MUST HAVE CABIN INTEGRITY OR SUIT LOOP CAPABLE OF SUPPORTING LIFE. ITEMS MARKED BY* ARE REQUIRED TO MAINTAIN SUIT LOOP

(8) BASED ON FAILUTE MODE, CONSIDERATION WILL BE GIVEN TO UNDOCKING WITH ONE GN_2 BOTTLE REMAINING IN AN OPERABLE SYSTEM

(9) MODE I AND II REGIONS ONLY, 0 THEREAFTER

(10) CONSIDERATION WILL BE GIVEN TO CONTINUING AFTER LOSS OF A TANK IF OTHER 2 TANKS MEET REDLINE CRITERIA

(11) BASED ON FAILURE MODE CONSIDERATION WILL BE GIVEN TO JETT LM WITH 1 REMAINING

(12) 1 OF 2 SUIT COMPRESSORS OR VACUUM CLEANER

LEGEND: ■ NO REQUIREMENTS

NOTE: A. T_2 NO STAY CONDITIONS
• NONE

CSM GNC GO CRITERIA (11/1/70)

GO/NO-GO ITEM	EARTH ORBIT			TLC			LUNAR ORBIT (BEFORE UNDOCKING)			UNDOCK	CIRC	POWERED DESCENT		LUNAR STAY		LUNAR ORBIT (P RNDZ)	POST DOCK
	CONT BOOST	CONT EO	TLI	TD&E	CONT TLC	NFR / LOI	CONT LOI	CONT LO	DOI			PDI	PDI TO TD	PAST TI	PAST T3 & SUBS	CONT L.O.	LM JETT
GNCS/SCS																	
DEORBIT CAPABILITY		SPS+B/U METHOD															
AUTO ATTITUDE CONTROL		← 3 AXIS		(1)	3 AXIS →			←	3-AXIS	→					2-AXIS	3-AXIS	(1)
RATE DAMPING		← 3 AXIS		(1)	3 AXIS →			←	3-AXIS	→					2-AXIS	3-AXIS	(1)
DIRECT RCS		← 3 AXIS		(1)	3 AXIS →			←	3-AXIS	→					2-AXIS	3-AXIS	(1)
BMAGS P,Y		← 1 OF 2 →				1 OF 2		←	1 OF 2	→					← 1 OF 2 →		
BMAGS R			1 OF 2			1 OF 2										1 OF 2	
FDAI		← 1 OF 2 →				1 OF 2		←	1 OF 2	→						1 OF 2	
THC		← THC →						←	THC	→							
RHC		← 1 OF 2 →				1 OF 2		←	1 OF 2	→						1 OF 2	
EMS																	
CMC			CMC			CMC		←	CMC	→					← CMC →		CMC
ISS			ISS			ISS		←	ISS	→					← ISS →		ISS
OSS			OSS			(3)		←	OSS OR VHF	→							
OPTICS DAC			O-DAC			O-DAC		←	O-DAC	→					← O-DAC →		
NO SOLENOID DR GND																	
TVC SERVO LOOP		1 OF 2	BOTH			BOTH	REFER TO MR 3-30	←	BOTH	→					← BOTH →		
DSKY			1 OF 2			1 OF 2		←	1 OF 2	→					← 1 OF 2 →		1 OF 2
SPS																	
FU/OX TANK (W/O LEAK)		← FU/OX →				FU/OX		←	FU/OX TANK	→					← FU/OX TNK →		
GN_2 TANK (W/O LEAK)		1 OF 2	BOTH			BOTH		←	BOTH	→					← BOTH →		
BALL VALVE BANK		1 OF 2	BOTH			BOTH		←	BOTH	→					← BOTH →		
FEEDLINE TEMP >40° F		← >40° →				>40°		←	>40°	→					← >40° →		
FU/OX ΔP < 20 PSI		← < 20 →				←		←	< 20	→					← < 20 →		
FLANGE TEMP < 480° F		< 480°	N/A			< 480°		←	< 480	→							
Pc >70 PSI		>70	N/A			>70		←	>70	→							
ULLAGE CAPABILITY			BOTH			1 OF 2		←	1 OF 2	→							
HE TANK (W/O LEAK)		(2)	HE TNK			← HE TNK →			← HE TNK →								
SM RCS																	
HE TANK (W/O LEAK)		3 OF 4	ALL			3 OF 4		3OF4 ←	ALL	→		3 OF 4 →			← 3 OF 4 →		3 OF 4
NO LEAK BELOW ISO VLV		3 OF 4	ALL	← 3 OF 4 →		4 OF 4		3OF4 ←	ALL	→					← 3 OF 4 →		4 OF 4
PKG TEMP >55°		3 OF 4	ALL	← 3 OF 4 →		3 OF 4		3OF4 ←	ALL	→		3 OF 4 →			← 3 OF 4 →		3 OF 4
THRUSTERS		ALL ROT AXES,+X TRANS	3 OF 4 P,Y 6 OF 8 R	(1)		3 OF 4 P,Y 6 OF 8 R		6OF8 ←	3 OF 4 P,Y ALL R	→		6 OF 8 R			3 OF 4 P,Y 6 OF 8 R	(1)	(1)
CM RCS																	
HE TANK (W/O LEAK)	1 OF 2 MODE 1	←		BOTH		→		←	BOTH	→					← BOTH →	BOTH	ONE
MANIFOLD (W/O LEAK)	1 OF 2 MODE 1	←		BOTH		→		←	BOTH	→					← BOTH →	BOTH	ONE
NOT ARMED		←		NOT ARMED		→										NOT ARMED	

(1) REQUIRES 3-AXIS ATTITUDE CONTROL AND TRANSLATION 3-AXIS (ONE LATERAL AXIS MAY BE DEGRADED)

(2) MUST HAVE SUFFICIENT ULLAGE FOR DEORBIT

(3) ASSUME LM CAN PROVIDE A GOOD ALIGNMENT

NOTE
1 T_2 NO STAY CONDITIONS
• NONE

LEGEND: NO REQUIREMENT

COLUMN APPLICABLE FOR NOT ARMED

LM TELMU GO CRITERIA
11/1/70

GO/NO-GO ITEM		UNDOCK	CIRC	POWERED DESCENT				LUNAR STAY			RENDEZVOUS LM ACTIVE		DOCKING
				PDI	PDI TO PDI + 5:30	PDI + 5:30 TO LO GATE	LO GATE TO T/D	STAY W/O EVA	2-MAN EVA	1-MAN EVA	CSI/CDH	TPI/TPF	
PYRO													
1. PYRO SYSTEMS **** ****		← BOTH →		← BOTH →	(5)	(5)	(5)	← BOTH →					
ELECTRICAL													
1. CDR AND LMP BUS (1)		← BOTH →		← BOTH →							← 1 OF 2 →		
2. DC FEEDERS (1) (2) **** ****	DESCENT	← BOTH →		← BOTH →									
	ASCENT	← BOTH →		← BOTH →							← 1 OF 2 →		
3. BATTERIES (3) **** ****	DESCENT	← 2 OF 4 →		← 2 OF 4 →				← 2 OF 4 →					
	ASCENT	← BOTH →		← BOTH →				← BOTH →			← 1 OF 2 →		
4. INVERTERS		← 1 OF 2 →		← 1 OF 2 →									
5. AC BUSES		← BUS A →		← BUS A OR B →									
ENVIRONMENTAL													
1. SUIT/CABIN INTEGRITY		← SUIT AND CABIN →		← SUIT AND CABIN →			SUIT	← SUIT AND CABIN →					
2. SUIT FANS **** ****		← 1 OF 2 →		← 1 OF 2 →					← 1 OF 2 →				
3. O_2 DEMAND REGS **** ****		←	1 OF 2 →					(4)	← 1 OF 2 →				
4. H_2O SEPARATORS **** ****		← 1 OF 2 H_2O SEPARATORS →		← 1 OF 2 H_2O SEPARATORS →				← 1 OF 2 H_2O SEPS →					
5. O_2 TANKS (3) **** ****	DESCENT	←	DESCENT →		(6)	2 OF 3 →		←	DESCENT →				
	ASCENT	←	1 OF 2 →						← 1 OF 2 →				
6. COOLANT LOOPS **** ****	PRIMARY	←	BOTH →		(6)	1 OF 2 →		←	BOTH →				
	SECONDARY												
7. H_2O FEED PATHS		←	BOTH →		(6)	1 OF 2 →		←	BOTH →				
8. H_2O TANKS (3) **** ****	DESCENT	←	DESCENT →		(6)	2 OF 3 →		←	DES →				
	ASCENT	←	1 OF 2 →					←	1 OF 2 →	(3)			
9. NO FIRE, SMOKE OR GLYCOL IN SUIT OR CABIN		←	→	←						←			

(1) DURING POWERED DESCENT WHEN TIME IS NOT AVAILABLE TO TROUBLESHOOT, A SHORT ON EITHER AN ASCENT OR DESCENT FEEDER WILL BE CONSIDERED LOSS OF A BUS AND THUS REQUIRE AN ABORT

(2) A SHORTED DC FEEDER WILL ALWAYS BE REASON FOR ABORTING THE LANDING MISSION. ONE OPEN DESCENT FEEDER WILL NOT BE REASON FOR ABORTING THE LANDING MISSION

(3) FUNCTIONAL CAPABILITY ONLY - SEE REDLINES FOR CONSUMABLES REQUIREMENTS

(4) DO NOT DEPRESS CABIN

(5) ABORT FOR ARMED SYSTEM THAT CAN NOT BE DEARMED

(6) CONSIDERATION WILL BE GIVEN TO CONTINUING DESCENT UNTIL THE SHORTER RDZ IS ACHIEVED AND THEN ABORT

LEGEND: **** **** RETAIN DESCENT STAGE ALAP
NO REQUIREMENT

NOTE:

1. T_1 NO STAY CONDITIONS:
   - LOSS OF 1 ASC BATT
   - LOSS OF BOTH COOLANT LOOPS
2. T_2 NO STAY CONDITIONS:
   - NONE

LM CONTROL GO CRITERIA
(11/1/70)

ITEM	UNDOCKING	CIRC	PDI	PDI TO PDI +5+30	PDI +5+30 TO HI GATE	HI GATE TO LO GATE	LO GATE TO TD	STAY W/O EVA	2 MAN EVA	1 MAN EVA	LM ACT RNDZ CSI/CDH	LM ACT RNDZ TPI/TPF	DOCKING
GNC													
1. GUID STEER — PGNS	←	←	←	←	→			← PGNS ⑥			← PGNS		
1. GUID STEER — AGS								⑥ OR AGS →			OR AGS →		
2. 3-AXIS ATT CONT — PGNS RATE CMD OR PGNS AUTO						② →					← PGNS		
2. 3-AXIS ATT CONT — AGS RATE CMD ①	← BOTH										OR AGS →		
3. 3-AXIS TRANS ⑧	← 3 AXIS →		+X								← 1 AXIS →		← 3 AXIS →
4. FDAI-ATT/RATES/ERR	← CREW OPTION						→						
5. T/D 40 SEC OF 57% GTC					← →								
6. VHF RNG/CSM OPTICS	← 2 OF 3 →												
7. RR													
8. AOT													
9. LR	←				→								
10. DPS AUTO ON ⑧													
11. REDNT APS ON ⑤	←			→				←		→			
12. P&R GDA TRIM			← NO IMPINGEMENT CONSTRAINTS				→						
13. MAN THTL ⑦ (1 TTCA)	← 1 OF 2						→						
14. AUTO THTL													
DPS													
1. FU OR OX INLET/ ULLAGE PRESS PSI <65%	←	≥30/≥30 →											
1. FU OR OX INLET/ ULLAGE PRESS PSI >65%	NA			←	→150/>160 →								
2. ΔP OX AND FU	← FU/OX ≤ 50	→		←	≤ 25 →								
3. PROP TEMP >50°<90°	←	→											
4. PROP ΔT < 10° F	←	→											
5. PROP QTY >LOW LEVEL/2%						← →							
6. FTP BLOWDOWN CAPABILITY	← <31% PQGS			→									
7. FU/OX PQGS ΔQ < 13% ④				←		→							
8. 35% EROSION EXCEEDED				←		→							
9. NO VENT OX ③								← >150 LB OX EACH TANK →					
APS													
1. NO PROP/HE LEAKS AND REDUNDANT PRESS PATHS	←						→	← IMMEDIATE LIFTOFF →			APS NOT REQ FOR RNDZ		
2. FU/OX INLET PRESS >62 & <220	←							→					
3. FU/OX ΔP (EITHER HIGH) < 90	←							→					
4. PROP TEMP >50° & <90°	←							→					
5. PROP ΔT < 10° F	←							→					
RCS													
1. RCS LEAKS	← NO HE/PROP LEAKS →			NO LEAK BETWEEN MAIN AND ISOL VALVE				← NO PROP LEAKS →					
2. FU/OX MANIF PRESS >100	←				A AND B			→			← A OR B →		
3. PROP TEMP (>40°F<100°F)	←				A AND B			→			← A OR B →		
4. 3-AXIS ATT CONTROL	← REDUNDANT →			←				3-AXIS →					
5. 3-AXIS TRANSLATION	← 3-AXIS →		+X								← 1-AXIS →		← 3-AXIS →
6. NO IMPINGEMENT LIMITS EXCEEDED	←						→						
7. NO PAIR ISOLATED	←		→										

① AGS RATE CMD MAY CONSIST OF 2 AXIS RATE CMD AND ONE DIRECT, I.E. ONE RATE GYRO FAILED

② FOR SINGLE CONTROL MODE LANDING IS CREW OPTION

③ < 150 LB CASE WILL BE EVALUATED PRIOR TO T3

④ MSFN WILL EVALUATE CAPABILITY TO LAND WITH RESPECT TO PROPELLANT REMAINING

⑤ MANUAL IS MANDATORY PLUS EITHER PNGS AUTO OR AGS AUTO

⑥ LOSS OF PGNS GUID STEERING IS ACCEPTABLE PROVIDED RDNT 3-AXIS ATT CONTROL

⑦ WORK AROUND PROCEDURE EXISTS FOR MAXIMUM THRUST

⑧ NO AUTO ULLAGE PLUS NO AUTO START - PDI NO GO

LEGEND: ■ NO REQUIREMENT

NOTE

1. T_1 NO STAY CONDITIONS:
   - APS PROP LEAK
   - RCS PROP LEAK (BOTH SYS)

2. T_2 NO STAY CONDITIONS
   - APS PROP LEAK
   - RCS LEAK (BOTH SYS)

FCD 5-69 .25 .5B

COMMUNICATIONS/INSTRUMENTATION GO CRITERIA

11/1/70

GO/NO-GO ITEM	EARTH ORBIT		TLC			LUNAR ORBIT (BEFORE UNDOCKING)			UNDOCKING	CIRC	POWERED DESCENT				LUNAR STAY			RENDEZVOUS LM ACTIVE		LUNAR ORBIT POST REND	POST DOCK
	CONT BOOST	CONT E.O.	TLI	TD&E	CONT TLC	LOI	CONT LOI	CONT L.O./DOI	NOMINAL MISSION		PDI	PDI TO PDI +5	PDI+5 TO LO GATE	LO GATE TO T/D	STAY W/O EVA	2-MAN EVA	1-MAN EVA	CSI/CDH	TPI/TPF	CONT L.O.	LM JETT
USB 2-WAY VOICE COMM		(1)	CSM			CSM		CSM OR LM (5)	CSM & LM	CSM	CSM AND LM	← (2) LM (2) →			CSM & LM (3)	CSM & LM (3)	CSM & LM (3)			CSM	CSM
VHF COMM LM/CSM									SIMPLEX OR ← DUPLEX	→											
VHF COMM LM/EVA																SIMP OR DUP	DUPLEX				
VHF COMM EVA/EVA																DUPLEX					
MSFN/EVA VOICE																EITHER CREWMAN					
CRITICAL INSTRUMENTATION		← CSM →				CSM		CSM	LM & CSM	CSM	← LM →				← LM AND CSM →			← LM →		CSM	
LM TELEMETRY									LBR OR HBR		← LBR OR HBR (4) (4) →				← LBR OR HBR →						
CSM TELEMETRY		← HBR OR LBR →			← HBR OR LBR →			← HBR OR LBR →							← HBR OR LBR →					HBR OR LBR	
CSM SCE			SCE																		

(1) VHF IS ACCEPTABLE

(2) CSM RELAY TO LM IS ACCEPTABLE

(3) LM RELAY TO CSM IS ACCEPTABLE

(4) ADEQUATE DATA TO MAKE FINAL GO/NO GO TO CONTINUE POWERED DESCENT

(5) CSM COMM IS REQUIRED FOR DOI

LEGEND: NO REQUIREMENT

EMU GO CRITERIA
(11/1/70)

GO/NO-GO ITEM	UNDOCKING	CIRC	POWERED DESCENT				LUNAR STAY (2)		
			PDI	PDI TO PDI+5 +30	PDI+5 +30 TO LO GATE	LO GATE TO T/D	STAY W/O EVA	2-MAN EVA	1-MAN EVA
CRITICAL INSTRUMENTATION								← EMU →	
LCG/LTL COOLANT LOOP								2 OF 2	1 OF 2
FEEDWATER SUPPLY								2 OF 2	1 OF 2
PRIMARY O_2 SUPPLY(S)	← (1) →							2 OF 2	1 OF 2
PLSS O_2 PRESSURE REG(S)								2 OF 2	1 OF 2
PLSS FAN(S)								2 OF 2	1 OF 2
PLSS BATTERY(S)								2 OF 2	1 OF 2
EMU PRESSURE INTEGRITY								2 OF 2	1 OF 2
OPS O_2 BOTTLE(S)	← (1) →							2 OF 2	1 OF 2
OPS PRESSURE REG(S)								2 OF 2	1 OF 2
CONTAMINATION CONTROL								2 OF 2	1 OF 2
BSLSS								(3)	

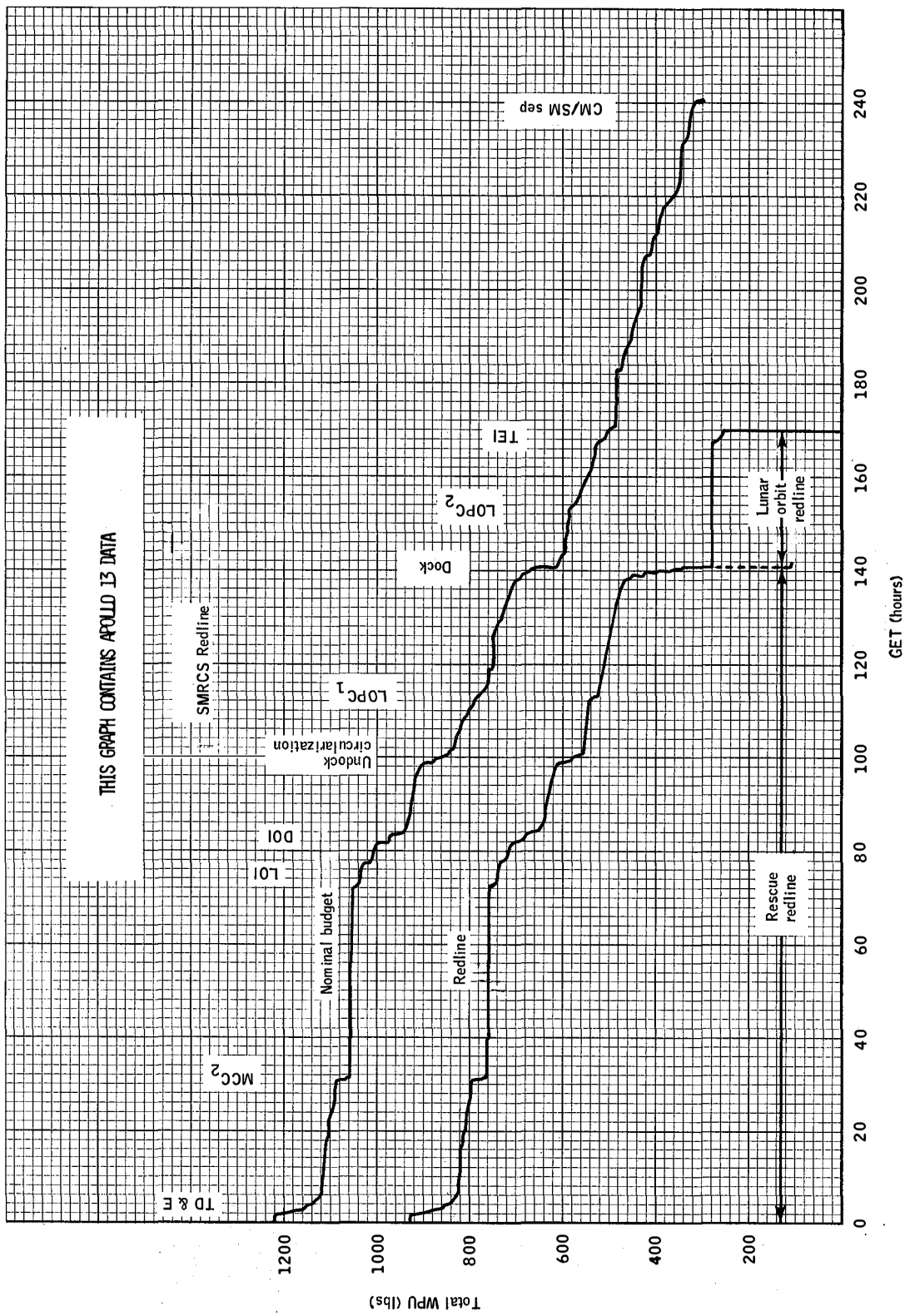
(1) NOMINALLY BOTH OPS'S SOURCE PRESSURES WILL BE CHECKED OUT PRIOR TO UNDOCKING - SHOULD ONE OPS SOURCE PRESSURE FAIL TO MEET THE OPS GO/NO-GO CRITERIA AS DEFINED IN RULE 3-103, A CHECK OF POS PRESSURE WILL BE MADE ON A PLSS TO FULFILL THE RQMT FOR TWO LIFE-SUPPORT UNITS

(2) SUFFICIENT PLSS AND/OR OPS CONSUMABLES WILL BE RETAINED AT LM LIFTOFF TO SUPPORT A 30 MINUTE CEVA

(3) REQUIRED FOR TRAVERSE DISTANCE GREATER THAN 1 KM FROM THE LM

LEGEND: NO REQUIREMENT

R	ITEM	
		' CONSUMABLES '
	3-90	SPS A. AFTER TD&E AND THE FIRST DOCKED SPS MCC, THE DELTA V REQUIRED TO CONTINUE WITH A LUNAR MISSION IS 5500 FPS (CSM UNDOCKED CAPABILITY). B. THE DELTA V REQUIRED FOR LOI GO IS LOI (FUNCTION OF LAUNCH DAY AND LAUNCH AZ) +3160 FPS (TEI AND TEC MCC'S). C. THE DELTA V REQUIRED FOR GO FOR UNDOCKING IS 4295 FPS. THIS DELTA V INCLUDES--- 700 FPS, LM RESCUE 75 FPS, CIRC 360 FPS, LOPC1 3500 FPS, TEI (APPROXIMATELY 91 HR RETURN) 160 FPS, 3 SIGMA MCC BASED ON SCS CONTROLLED TEI 4295 FPS
	3-91	SM RCS A. THE CSM RESCUE REDLINE INCLUDES--- (1) NOMINAL USAGE FROM LAUNCH TO CSM CIRCULARIZATION BURN. (2) ATTITUDE HOLD FROM CIRCULARIZATION BURN TO LM LIFTOFF (INCLUDED IN THIS PERIOD IS LOPC 1 ULLAGE AND DAMPING). (3) RESCUE ALLOWANCE INCLUDING NOMINAL RENDEZVOUS BUDGET, THREE 10-SECOND 4-JET ULLAGES, AND CSM ACTIVE BRAKING. (4) TWO REVS ATTITUDE HOLD PLUS TEI (ULLAGE AND DAMPING). (5) 7 FPS MCC (1 SIGMA G&N TEI CUTOFF). (6) PTC ALLOWANCE. (7) NOMINAL USAGE FROM MCC 7 TO CM/SM SEP. THE REDLINE DOES NOT INCLUDE CSM SOLO EXPERIMENTS, BOOTSTRAP PHOTOGRAPHY, OR P23'S IN TEC. THE CSM RESCUE REDLINE AT EARTH LAUNCH IS 940 LBS. B. VIOLATION OF THE LUNAR ORBIT REDLINE WILL RESULT IN TERMINATION OF LUNAR ORBIT ACTIVITIES. THE LO REDLINE INCLUDES--- 206 LB 2 REVS LO, TEI ULLAGE AND DAMPING, NOMINAL TEC BUDGET 59 LB 20 FPS MCC (3 SIGMA G&N TEI CUTOFF) 265 LB RULE NUMBERS 3-92 AND 3-93 ARE RESERVED.


THIS GRAPH CONTAINS APOLLO 13 DATA
SMRCS Redline
Undock circularization
LOPC1
Dock
LOPC2
TEI
CM/SM sep
Lunar orbit redline
Rescue redline
Redline
Nominal budget
LOI
DOI
MCC2
TD & E
Total WPU (lbs)
1200
1000
800
600
400
200
0
20
40
60
80
100
120
140
160
180
200
220
240
GET (hours)

R	ITEM
	3-94

CSM BATTERY ENERGY AND CRYOGENIC O2 AND H2

THE FOLLOWING MINIMUM USABLE ENERGY/QUANTITIES MUST BE AVAILABLE TO INITIATE THE SPECIFIC PHASES.

		LAUNCH	LOI	UNDOCK	PC-1	PC-2
BATT AMP-HOURS REMAINING	3 BATT	TBD (1)	TBD (2)	TBD (2)	TBD (3)	NA
	2 BATT	TBD	TBD	39.8	TBD	NA
O2 (PERCENT EACH TANK)		TBD	TBD	TBD	TBD	N/A
H2 (PERCENT EACH TANK)		TBD	TBD	TBD	TBD	NA

(1) ENERGY REQUIREMENT TO PERFORM NOMINAL MISSION WITHOUT CHARGER. REDLINE DOES NOT ALLOW PRE-LOI GIMBAL DRIVE CHECK OR BACKUP SPS BURN PREPS AND REQUIRES POWER DOWN OF ECS RADIATOR HEATERS OVERLOAD SENSING.

(2) ALLOWS NOMINAL LUNAR STAY, BUT PRECLUDES PC-1 BURN.

(3) ENERGY REQUIRED TO PERFORM PC-1

NOTES

(A) PRELAUNCH BATTERY REDLINES ARE BASED ON FAILURE OF THE BATTERY CHARGER BEFORE ACCOMPLISHING ANY CHARGING.

(B) THE TWO BATTERY REDLINES REFLECT THE ENERGY REQUIRED IN THE TWO LOWEST BATTERIES TO PROVIDE CAPABILITY FOR A SAFE RETURN FROM ANY POINT IN THE MISSION. THE REDLINES ARE BASED ON LOSS OF THE HIGHEST BATTERY SUBSEQUENT TO LOSS OF THE BATTERY CHARGER WITH A TWO-BATTERY ENTRY (WITH G&N) AND 12 HOURS OF POSTLANDING TIME.

(C) IF RESCUE IS REQUIRED, THE THREE-BATTERY ENERGY REQUIREMENTS WILL BE RECOVERED BY POWERING DOWN TO A TWO-BATTERY G&N ENTRY.

(D) AUX BATT ENERGY NOT INCLUDED IN BATT REDLINES

(E) CRYOGENIC REDLINES ARE BASED ON CAPABILITY TO PERFORM NOMINAL MISSION WITH CAPABILITY TO RETURN TO EARTH WITH A 40 AMP AVERAGE POWER LEVEL AFTER LOSS OF ONE CRYO TANK AT TBD (WORST CASE TIME FOR FAILURE).

RULES 3-95 AND 3-96 ARE RESERVED.

R	ITEM
	3-97

LM-RCS PROPELLANT GO/NO-GO'S AND REDLINES

A. ASSUMPTIONS

1. TOTAL LOADED 633 LBS EQUAL 100 PERCENT

UNUSABLE

TRAPPED PROPELLANT	7.3 PERCENT
GROUND GAGING UNCERTAINTY	6.0 PERCENT
TOTAL UNUSABLE	13.3 PERCENT

2. OPS RESERVE

(A) PRIOR TO TPF - ONE REV LOS TRACKING OF CSM (STAGED) EQUALS 2.5 PERCENT

(B) AFTER TPF - CSM ACTIVE DOCKING EQUALS 1.0 PERCENT

3. ALL GO/NO-GO'S ARE THE AVERAGE OF SYSTEM A&B. ALL REDLINES REQUIRE A PERCENT READING ON EACH INDIVIDUAL SYSTEMS GAUGE (OR AN EQUIVALANT AMOUNT OF PROPELLANT IF THE GAUGE HAS FAILED) EQUAL TO OR GREATER THAN THE REDLINE VALUE.

4. THE TWEAK BURN IS ASSUMED TO BE 10 FPS IN THE X AXIS AND 20 FPS IN THE Z AXIS.

B. GO/NO-GO'S

1. UNDOCKING/SEPARATION---

PROPELLANT REQUIRED FOR UNDOCKING, DESCENT, ASCENT AND ONE REV RENDEZVOUS PLUS OPS RESERVE.

2. PDI

PROPELLANT REQUIRED FOR DESCENT, ASCENT AND ONE REV RENDEZVOUS PLUS OPS RESERVE.

3. TWEAK

PROPELLANT REQUIRED FOR NOMINAL LM ACTIVE ONE REV RNDZ PLUS OPS RESERVE

(A) PROPELLANT REQUIRED FOR NOMINAL LM ACTIVE ONE REV RNDZ PLUS OPS RESERVE EXCEPT TPF

(B) PROPELLANT REQUIRED FOR BAILOUT, 3 REV LOS, DOCKING PLUS OPS RESERVE

4. TPI

PROPELLANT REQUIRED FOR REMAINDER OF ONE REV RNDZ PLUS OPS RESERVE.

(A) PROPELLANT REQUIRED FOR REMAINDER OF ONE REV RNDZ PLUS OPS RESERVE EXCEPT TPF.

5. TPF

PROPELLANT REQUIRED FOR REMAINDER OF ONE REV RNDZ PLUS OPS RESERVE.

R	ITEM
	3-97 CONT.

C. REDLINES

1. UNDOCKING TO CIRC

   PROPELLANT REQUIRED FOR NOMINAL DOCKING PLUS OPS RESERVE

2. CIRC TO PDI

   PROPELLANT REQUIRED FOR LOS IN LONGEST ABORT RNDZ WITH DPS ATTACHED UNTIL JUST BEFORE TPF (P-20 MAXIMUM DEADBAND), STAGING, BRAKING, DOCKING PLUS OPS RESERVE.

3. PDI TO TOUCHDOWN

   PROPELLANT REQUIRED FOR DESCENT, NOMASCENT, LONGEST LOS FOR CSM RESCUE (P-20 MAXIMUM DEADBAND), BRAKING, DOCKING PLUS OPS RESERVE.

4. LUNAR STAY
   PROPELLANT REQUIRED FOR NOM ASCENT, LONGEST LOS FOR CSM RESCUE (P20 MAX DEADBAND), BRAKING, DOCKING, PLUS OPS RESERVE.

5. ASCENT TO TWEAK

   PROPELLANT REQUIRED FOR ASCENT, TWEAK, ONE REV RNDZ (CSM ACTIVE), DOCKING, PLUS OPS RESERVE.

6. TWEAK TO TPF

   PROPELLANT REQUIRED FOR ONE REV RNDZ (CSM ACTIVE), DOCKING, PLUS OPS RESERVE.

7. TPF TO DOCKING

   PROPELLANT REQUIRED FOR OPS RESERVE

RULES 3-98 THROUGH
3-101 ARE RESERVED.

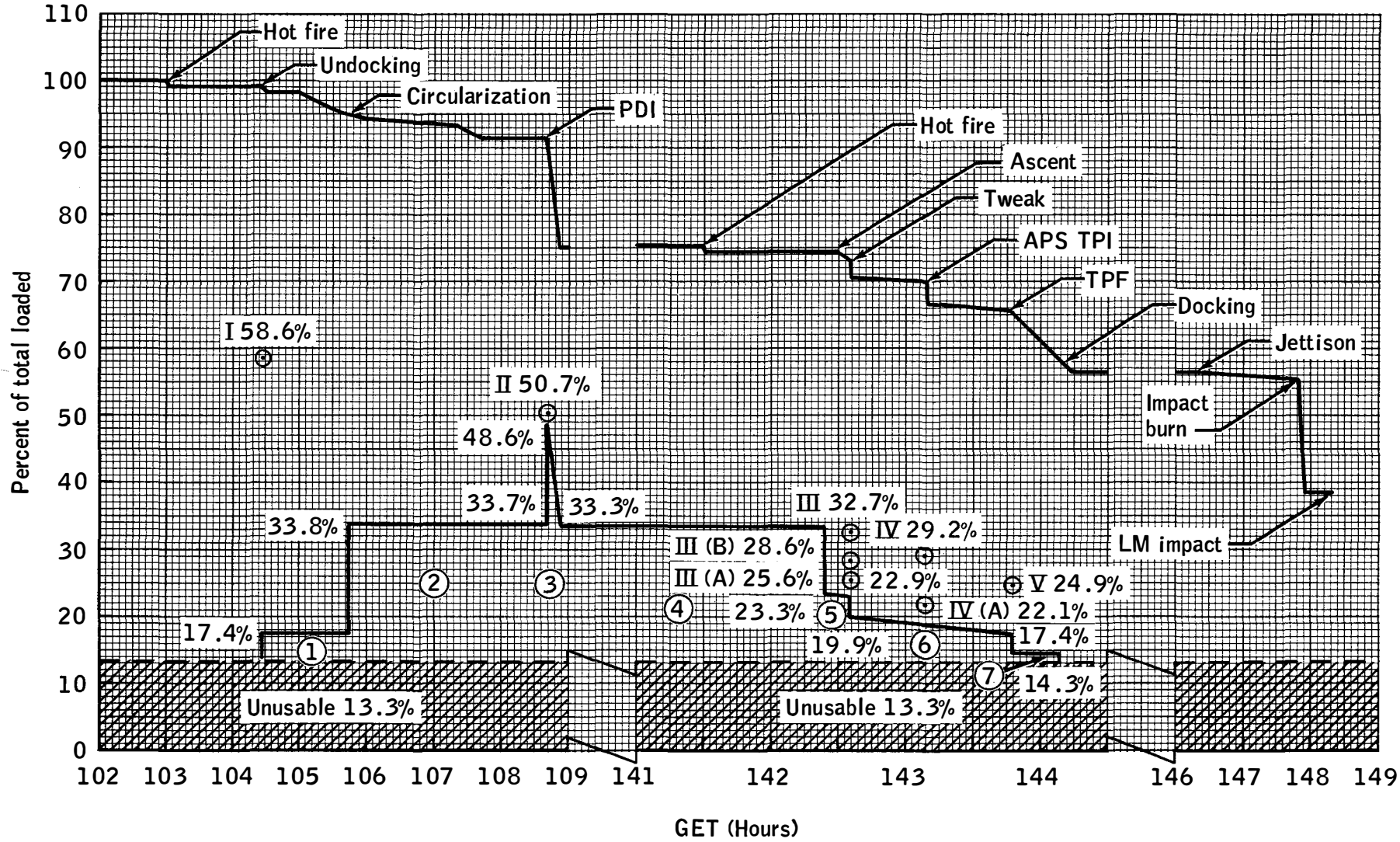


Figure.- LM RCS propellant profile.

R	ITEM	
	3-102	LM EPS, ECS

THE LM EPS AND ECS MINIMUM CONSUMABLE REQUIREMENTS ARE DEFINED AS FOLLOWS---

A. FROM UNDOCKING TO TOUCHDOWN, THE MINIMUM REQUIREMENTS ARE BASED ON THE TIME TO COMPLETE A LANDING, A 24.5-HR STAY WITH 1 EVA, ASCENT, AND A 4.5 HR RENDEZVOUS THROUGH CREW TRANSFER, A TWO HOUR ORBITAL CONTINGENCY, AND REDUNDANT ASCENT EPS SOURCES FOR THE RENDEZVOUS.

THE TIME TO COMPLETE A LANDING AND THE 24.5-HR LUNAR STAY MAY BE SUPPORTED BY ANY COMBINATION OF DESCENT AND ASCENT CONSUMABLES. IN ADDITION, EACH ASCENT BATTERY, ONE H2O TANK AND ONE ASCENT O2 TANK (THE LM CABIN IS CONSIDERED A REDUNDANT O2 SOURCE) MUST CONTAIN THE CONSUMABLES REQUIRED FOR LIFTOFF AND A 4.5HR RENDEZVOUS THROUGH CREW TRANSFER. THE TWO-HOUR ORBITAL CONTINGENCY, INSOFAR AS ASCENT O2, AND ELECTRICAL POWER ARE CONCERNED, IS CONSIDERED TO BE SATISFIED BY THE REDUNDANCY REQUIREMENT. SHOULD TWO ASCENT H2O TANKS BE AVAILABLE, THE REQUIREMENT FOR LIFTOFF THROUGH CREW TRANSFER CAPABILITY IN EACH TANK WILL SATISFY THE TWO-HOUR ORBITAL CONTINGENCY. IF ONLY ONE TANK IS AVAILABLE, IT MUST ALSO INCLUDE THE TWO-HOUR CONTINGENCY.

B. FOR THE REMAINDER OF THE LUNAR STAY, THE MINIMUM DESCENT STAGE REQUIREMENTS ARE BASED ON THOSE CONSUMABLES REQUIRED FOR THE SCHEDULED ACTIVITIES DURING EACH DEFINED PHASE, AN ASCENT PREPARATION AND A TWO-HOUR SURFACE RESERVE. THE LAST FOUR HOURS OF THIS REQUIREMENT FOR EPS MUST BE SPLIT-BUS OPERATION. ASCENT STAGE MINIMUM REQUIREMENTS ARE AS STATED ABOVE.

C. FOR THE RENDEZVOUS, THE MINIMUM REQUIREMENTS ARE THOSE CONSUMABLES NECESSARY TO SUPPORT A LM-ACTIVE RENDEZVOUS THROUGH CREW TRANSFER. SHOULD THESE MINIMUM REQUIREMENTS BE VIOLATED, THE LM WILL BE POWERED DOWN WHILE THE CSM BECOMES THE ACTIVE VEHICLE. HOWEVER, THE LM WILL BE POWERED UP TO PERFORM BRAKING-- SUFFICIENT CONSUMABLES BEING RETAINED FOR THIS PURPOSE.

R | ITEM

3-102 CONT.

	GO/NO GO			STAY/NO STAY	
	UNDOCK	CIRC	PDI	LUNAR STAY	
	ROM(1) WITH 25.5-HR STAY	ROM WITH 25.5-HR STAY	ROM WITH 25.5-HR STAY	ROM(2) 24.5-HR WITH 1 EVA	ROM(2) 32.5-HR WITH 2 EVA'S
ASC O2 (LBS EITHER TANK)	1.5	1.5	1.5	1.5	1.5
PLUS					
ASC/DES O2 (LBS)	24.6	24.1	23.4	23.1	31.7
ASC H2O (4)	40	40	40	40	40
PLUS					
ASC/DES H2O (LBS)	145	133	113	108	154
ASC AMP HRS (EACH BAT)	206	206	206	191	191
PLUS					
ASC/DES AMP HOURS	1024	963	826	761	994

(1) ROM = REMAINDER OF MISSION

(2) APPLIED AT T3-60 MIN, I.E. TOTAL SURFACE STAY TIMES ARE 25.5 AND 33.5 HOURS.

(3) LM IS ''STAY'' IF SUFFICIENT ASCENT/DESCENT H2O AND ELECTRICAL POWER ARE AVAILABLE TO PROVIDE A T3 LIFTOFF, NOMINAL INSERTION & CSM RESCUE CAPABILITY AS A MINIMUM. LM IS ''STAY'' EVEN IF ALL TANKED O2 IS LOST.

(4) ASSUMES ONLY ONE ASCENT H2O TANK AVAILABLE. IF TWO ARE AVAILABLE, EACH MUST CONTAIN 29 LBS.

GENERAL NOTE

VALUES IN TABLE ARE THE REQUIRED USABLE AMOUNTS. UNUSABLES ARE---

	O2	H2O	A-H
ASC	.37	2.08	11
DES	3.39	16.4	27

(PER TANK OR BATTERY FOR A FOUR DESCENT/TWO ASCENT BATTERY CONFIGURATION)

R | ITEM

3-103 EMU

A. PLSS AMP HRS, O2, LIOH, & H2O REDLINES

NOMINAL AND ALTERNATE EVAS-THE PLSS AMP-HRS, O2, LIOH, AND H2O REDLINES FOR EACH OF THE NOMINAL OR ALTERNATE EVA'S ARE DEFINED AS THOSE VALUES REQUIRED FOR 30 MINUTES OF POST EVA RESERVE.

B. PLSS AMP-HR, O2, LIOH AND H2O GO/NO GO'S ARE DEFINED AS THOSE VALUES REQUIRED TO COMPLETE THE EVA (NOMINAL OR ALTERNATE) PLUS THE VALUES REQUIRED FOR 30 MINUTES OF POST EVA RESERVE.

C. NOMINAL (4 HR 15 MIN) EVA REQUIREMENTS PER CREWMAN

	GO/NO-GO'S	
	EVA NO. 1	EVA NO. 2
	4 HR 15	4 HR 15
POS (PSIA)	954	954
H2O (LBS)	6.4	7.3
AMP-HRS	15.2	15.2
LIOH (BTU'S)	5400	5400

ASSUMPTIONS	EVA 1	EVA 2
MET RATE	1050 BTU/HR	1050 BTU/HR
HEAT LEAK	-100 BTU/HR	+100 BTU/HR
O2 LEAK RATE	0.035 LBS/HR	0.035 LBS/HR

R	ITEM
	3-103 CONT.

D. OPS O2, PLSS O2, H2O AND AMP-HRS GO/NO-GO'S ARE DEFINED AS THOSE VALUES REQUIRED TO COMPLETE A 30-MINUTE CEVA.

CEVA GO/NO-GO TABLE		
OPS	ACTIVATED	4600 PSIA/4.8 LBS
	UNACTIVATED	5380 PSIA/5.6 LBS
PLSS	POS	325 PSIA/0.4 LBS
	H2O	1.7 LBS
	BAT	3.2 AMP-HRS
	LIOH	800 BTU'S

ASSUMPTIONS

MET RATE	1050 BTU/HR
O2 LEAK RATE	0.035 LBS/HR

4 GROUND INSTRUMENTATION REQUIREMENTS

R	ITEM	
	4-1	GENERAL

A. THE FOLLOWING PRELAUNCH REQUIREMENTS DEFINE THE MCC/MSFN REQUIREMENTS WHICH MUST BE MET BEFORE A "GO" IS GIVEN FOR LAUNCH.

B. WHEN A SPECIFIC HARDWARE ITEM OR OPERATIONAL CAPABILITY IS DEFINED AS A MANDATORY ITEM, THE HARDWARE AND/OR SOFTWARE INTERFACE REQUIRED TO PROVIDE THE MANDATORY FUNCTIONS OF THAT HARDWARE ITEM OR OPERATIONAL CAPABILITY ARE TO ASSUME A MANDATORY STATUS ALSO.

C. WHERE REDUNDANCY EXISTS FOR MANDATORY ITEMS, A BACKUP CAPABILITY IS CONSIDERED HIGHLY DESIRABLE.

NOTE

THE VARIOUS EQUIPMENT LISTINGS IN THIS SECTION ARE TO BE UTILIZED AS A GUIDE ONLY. IT IS MANDATORY, PRIOR TO COMMITTING THE MISSION TO LAUNCH, TO BE ABLE TO---

A. RECEIVE AND DISPLAY TELEMETRY AND TRACKING DATA.

B. MAINTAIN VOICE COMMUNICATIONS WITH THE CREW.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	4-2	TELEMETRY			
		A. CONSOLE DISPLAY (D/TV, EVENTS, ANALOGS)	PRELAUNCH	MANDATORY	A. FOR DISPLAY OF MANDATORY S/V PARAMETERS.
		B. PCM GROUND STATIONS (4)	PRELAUNCH	1 OF 4 MANDATORY, 1 HIGHLY DESIRABLE	B. FOR DISPLAY OF MANDATORY S/V EVENTS AND ANALOGS.
		C. RECORDING AND PLAYBACK			
		ALDS	PRELAUNCH	BOTH DESIRABLE	
		MSFN			
		D. FM - GROUND STATION	PRELAUNCH	HIGHLY DESIRABLE	
	4-3	COMMAND			
		A. MOCR TOGGLE SWITCHES (BOTH A AND B)			A. FOR LAUNCH PHASE ABORT REQUEST
		1. BSE ABORT REQUEST	PRELAUNCH	HIGHLY DESIRABLE	
		2. FIDO ABORT REQUEST	PRELAUNCH	HIGHLY DESIRABLE	
		3. FD ABORT REQUEST	PRELAUNCH	HIGHLY DESIRABLE	
		B. COMMAND PANELS--- INCO, GUIDO, BSE, TELCOM, CONTROL, CCATS	PRELAUNCH	HIGHLY DESIRABLE	
		C. MOCR CONSOLE/SITE SELECT CAPABILITY			
		1. RTC CONSOLE (CCATS)	PRELAUNCH	HIGHLY DESIRABLE	
		2. CCATS CMD CONSOLE MED			
		D. FC/M&O SWITCHING CAPABILITY			
		1. CCATS	PRELAUNCH	HIGHLY DESIRABLE	
		2. CCATS CMD MED			
		E. ABORT/CCATS TEST SWITCHING CAPABILITY	PRELAUNCH	HIGHLY DESIRABLE	
		1. FD CONSOLE			
		2. CCATS CMD MED.			

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	4-4	TRAJECTORY			
		A. TRAJECTORY DATA PROCESSING			A. THE TRAJECTORY DATA SOURCES ARE UTILIZED AS FOLLOWS---
		1. AVAILABILITY OF ONE INDEPENDENT TRACKING SOURCE (IPR, USB) FROM LIFTOFF TO T + 10 MINUTES.	PRELAUNCH	1 MANDATORY	1. (A) INDEPENDENT VERIFICATION OF L/V NAVIGATION. (B) PROTECTION AGAINST VIOLATION OF LAUNCH ENVELOPE.
		2. IU AND CMC TM VECTORS FROM LIFTOFF TO INSERTION PLUS 60 SECONDS.	PRELAUNCH	BOTH MANDATORY	A.2. REQUIRED FOR ORBIT GO/NO-GO
		B. RTCC - DATA SELECT CAPABILITY	PRELAUNCH	MANDATORY	B. TO SELECT BEST AVAILABLE DATA SOURCE.
	4-5	COMMUNICATIONS			
		A. MOCR---			
		AFD CONF LOOP FD LOOP	PRELAUNCH	1 OF 2 MANDATORY	FOR MISSION CONTROL
		MOCR DYN MOCR SYS 1 & 2 A/G 1 LOOP A/G 2 LOOP	PRELAUNCH	ALL HIGHLY DESIRABLE	
		B. MCC/LAUNCH COMPLEX---			
		121 CLTC 111 CVTS 212 MSTC	PRELAUNCH	1 OF 3 MANDATORY	FOR TERMINAL COUNT COORDINATION OF MCC-PAD ACTIVITIES
		C. MCC/RSO---			
		FD LINE TO RSO RSO PRIVATE LINE CAPE 111 RSO LOOP	PRELAUNCH	1 OF 3 MANDATORY	FOR TRAJECTORY VERIFICATION AND BOOSTER SAFING
		D. MISCELLANEOUS---			
		BSE TM MONITOR LOOP CIF/USB LOOP	PRELAUNCH	DESIRABLE	USED FOR MONITORING SPACE VEHICLES SUBSYSTEM CHECKOUT
		E. MCC/REMOTED SITES---			
		ONE A/G PATH	PRELAUNCH	MANDATORY	USED FOR COMMUNICATION WITH CREW

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	4-6	COMPUTER			
		A. MOC (IBM 360/75)	PRELAUNCH	MANDATORY	TO PROCESS MANDATORY S/V PARAMETERS AND TRAJECTORY DATA
		B. DSC (IBM 360/75)	PRELAUNCH	HIGHLY DESIRABLE	AN SSC (IBM 360/75) IS AVAILABLE AS BACKUP TO THE MOC OR DSC.
		C. CCATS (UNIVAC 494)- ONLINE	PRELAUNCH	1 MANDATORY AND 1 HIGHLY DESIRABLE	TO THROUGH PROCESS MANDATORY S/V PARAMETERS TO MOC
		CCATS (UNIVAC 494) - STANDBY			
		D. RTACF - 2	PRELAUNCH	1 HIGHLY DESIRABLE	PRELAUNCH IP PREDICTIONS FOR MODE 1 ABORTS.
	4-7	TIMING MITE (2)	PRELAUNCH	1 MANDATORY	MCC TIMING STANDARD TO SUPPORT MANDATORY RTCC/CCATS COMPUTERS

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	4-8	MCC POWER			
		A. BUS A1	PRELAUNCH	MANDATORY	UNINTERRUPTABLE POWER FOR D/TV CONVERTERS
		B. BUS A2	PRELAUNCH	MANDATORY	UNINTERRUPTABLE POWER FOR D/TV DATA DISTRIBUTORS AND VSM
		C. BUS B1	PRELAUNCH	HIGHLY DESIRABLE	20 SECONDS INTERRUPTABLE POWER FOR THE FOLLOWING HIGHLY DESIRABLE ITEMS--- - FLT DYN SSR CONSOLES AND PLOTBOARDS - RTCC CONSOLES (EXCEPT COMP SUP) - RTACF - PDSDD - CMCC - TTY
		D. BUS B2	PRELAUNCH	MANDATORY	20 SECONDS INTERRUPTABLE POWER FOR MOCR AND SSR CONSOLES
	4-9	DISPLAY			
		A. MOCR D/TV CHANNELS POSITION — NO. OF CHANNELS RETRO 1 FIDO 1 GUIDO 1 EECOM 1 GNC 1 RTCC 1 BOOSTER 4	PRELAUNCH	10 OF 36 MANDATORY	FOR DISPLAY OF MANDATORY S/V PARAMETERS
		B. TRAJECTORY DISPLAY			
		1. FDO LAUNCH DIGITALS	PRELAUNCH	MANDATORY ON D/TV	FOR CONTINGENCY ORBIT INSERTION MANEUVER DATA AND TFF LIMITS.
		2. GAMMA VS V	PRELAUNCH	MANDATORY ON 1 OF 4--- (A) 10 X 20 SCRIBER PLOTTER (B) D/TV (C) RTCC PLOTBOARD (D) SSR PLOTBOARD	FROM SELECTED TRACKING DATA SOURCE.
		3. RFO LAUNCH DIGITALS	PRELAUNCH	MANDATORY ON D/TV	MONITOR FOR MODES III AND IB MANEUVER DATA.
		4. GAMMA(EI) VS V(EI)	PRELAUNCH	MANDATORY ON 1 OF 2--- (A) D/TV (B) SSR PLOTBOARD	MONITOR FOR G-LIMIT VIOLATION.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	4-9 CONT	5. PHI VS LAMBDA	PRELAUNCH	HIGHLY DESIRABLE ON 1 OF 2--- PLOTBOARD (A) RTCC (B) SSR PLOTBOARD	MONITOR FOR CROSS-RANGE LIMITS
		6. T(FF) VS R(IP)	PRELAUNCH	HIGHLY DESIRABLE ON 1 OF 2--- (A) D/TV (B) SRR PLOTBOARD	MONITOR FOR ABORT MODES II, III, AND IB.
		7. H VS D	PRELAUNCH	HIGHLY DESIRABLE ON 10 X 20 SCRIBER PLOTTER	
		8. GAMMA(I) VS V(I) (CMC DYNAMIC STATUS)	PRELAUNCH	HIGHLY DESIRABLE ON 10 X 10 SCRIBER PLOTTER	MONITOR FOR L/V AND S/C NAVIGATION PERFORMANCE (GUIDANCE SYSTEM ANALYSIS - COMPARES CMC WITH TRACKING).
		9. WEDGE ANGLE MONITOR	PRELAUNCH	HIGHLY DESIRABLE ON D/TV	MONITOR FOR L/V AND S/C NAVIGATION PERFORMANCE
		10. GUIDO ANALOG CHART RECORDERS ONE AND TWO	PRELAUNCH	HIGHLY DESIRABLE ON TV	
		11. INSERTION/INJECTION DIGITALS	PRELAUNCH	MANDATORY ON D/TV	FOR G&N GO/NO-GO
		C. ADEG CHANNELS 90-93	PRELAUNCH	HIGHLY DESIRABLE	FOR DSC DISPLAYS
		D. VSM	PRELAUNCH	MANDATORY	FOR D/TV
		E. AUX VSM	PRELAUNCH	HIGHLY DESIRABLE	
		F. EIDOPHORS (3)	PRELAUNCH	2 HIGHLY DESIRABLE	

NOTE--- INDIVIDUAL FLIGHT CONTROLLERS WILL BE RESPONSIBLE FOR REPORTING LOSS OF DISPLAY CAPABILITY OF MANDATORY PARAMETERS TO THE FLIGHT DIRECTOR.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	4-10	GSFC			
		A. GSFC UNIVAC - 494 (2) COMMUNICATIONS PROCESSOR	PRELAUNCH	1 MANDATORY	A. ONE UNIVAC - 494 CAN PERFORM ALL NECESSARY FUNCTIONS, THE SECOND ONE IS BACKUP.
		B. WBD (50.0 KBPS) LINES (2) BETWEEN MCC AND GSFC	PRELAUNCH	1 MANDATORY	B. EITHER LINE CAN BE SWITCHED TO EITHER UNIVAC - 494.
		C. TTY CIRCUITS BETWEEN MCC AND GSFC			C. VFTG PROVIDES TWO REDUNDANT 16 CIRCUIT TTY CHANNELS.
		1. OUTGOING	PRELAUNCH	1 OF 32 CIRCUITS HIGHLY DESIRABLE	1. FOR ACQ MSG, LS CMD
		2. INCOMING (JJ)	PRELAUNCH	1 OF 32 CIRCUITS MANDATORY	2. FOR RECEPTION OF LOWSPEED RADAR DATA.
	4-11	KSC			
		TELEMETRY---			
		A. VHF TM FROM THE FOLLOWING FOR S-II, S-IVB, AND IU---			A. THESE ANTENNAS CAN BE SWITCHED TO MILA OR CIF FACILITIES
		1. CIF ANTENNA	PRELAUNCH	1 HIGHLY DESIRABLE	
		2. MILA VHF ANTENNA			
		B. USB TM FROM THE FOLLOWING---			B. USB IS THE CSM'S ONLY SOURCE OF DATA.
		1. MILA USB	PRELAUNCH	1 MANDATORY	
		2. CIF USB			
		COMMAND---			
		THIS CAPABILITY IS DEFINED UNDER GSFC/KSC/MSFN COMMAND RULE 4-12 FOR LAUNCH COVERAGE.			
		TRACKING---			
		THAT CAPABILITY REQUIRED TO SATISFY RULE 4-4 (TRAJECTORY) IS MANDATORY.			
		VOICE COMMUNICATIONS---			
		THIS KSC CAPABILITY IS DEFINED UNDER MCC RULE 4-5 (COMMUNICATIONS).			

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	4-12	LAUNCH COVERAGE			
		KSC/MSFN SITES (SITES NOT LISTED DUE TO VARIABLE LAUNCH AZIMUTH) MUST PROVIDE THE FOLLOWING CAPABILITIES FROM LIFTOFF THROUGH S-IVB CUTOFF PLUS 60 SECONDS. REFER TO DECISION MATRIX (RULE 4-16 AND FIGURES 4-1 THROUGH 4-5) TO DETERMINE CAPABILITY.			
		A. CMD			
		CCS	PRELAUNCH	HIGHLY DESIRABLE	
		B. TELEMETRY			
		S-IC (VHF)	PRELAUNCH	HIGHLY DESIRABLE	S-IC DATA IS ONLY HIGHLY DESIRABLE SINCE THE MCC IS NOT PRIME FOR REQUESTING AN ABORT FOR S-IC MALFUNCTIONS.
		S-II (VHF)	PRELAUNCH	HIGHLY DESIRABLE FROM LIFTOFF TO S-II CUTOFF (APPROX. 8 + 36 SEC)	FOR ABORT CUES FROM MCC
		S-IVB VHF (CP-1)	PRELAUNCH	HIGHLY DESIRABLE	
		IU CCS (DP-1B) IU VHF (DP-1)	PRELAUNCH	1 OF 2 MANDATORY	FOR ABORT CUES FROM MCC
		CSM (USB)	PRELAUNCH	MANDATORY FROM LIFTOFF THROUGH S-IVB CUTOFF PLUS 60 SEC.	FOR ABORT CUES FROM MCC
		C. TRACKING			
		THAT CAPABILITY REQUIRED TO SATISFY RULE 4-4 (TRAJECTORY) IS MANDATORY			
		D. A/G COMMUNICATIONS			
		1. MILA VHF USB	PRELAUNCH	1 OF 2 MANDATORY	
		2. MSFN VHF USB	PRELAUNCH	1 OF 2 MANDATORY	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	4-13	GENERAL ORBITAL COVERAGE			
		IT IS REQUIRED THE MSFN HAVE THE CAPABILITY OF PROVIDING THE MCC MINIMUM MISSION CONTROL SUPPORT LISTED BELOW OF TWO MSFN USB SITES PER REVOLUTION THROUGH REVOLUTION 3.			
		A. CMD			
		CCS	PRELAUNCH	HIGHLY DESIRABLE	
		CSM USB	PRELAUNCH	HIGHLY DESIRABLE	
		B. TELEMETRY			
		S-IVB VHF (CP-1)	PRELAUNCH	HIGHLY DESIRABLE	
		IU CCS (DP-1B)	PRELAUNCH	1 OF 2 MANDATORY	DOWNLINKS REQUIRED TO RECOVER S-IVB DATA.
		IU VHF (DP-1)			
		CSM USB	PRELAUNCH	MANDATORY	
		C. TRACK			
		C-BAND	PRELAUNCH	HIGHLY DESIRABLE	
		USB	PRELAUNCH	MANDATORY	
		D. A/G COMMUNICATIONS			
		VHF	PRELAUNCH	1 OF 2 MANDATORY	USB MANDATORY AT LEAST ONE STATION PRIOR TO TLI TO CONFIRM ONBOARD CSM USB A/G CAPABILITY.
		USB	PRELAUNCH		
	4-14	POST S/C SEPARATION			
		IT IS MANDATORY THAT 1 SITE PROVIDE THE FOLLOWING CAPABILITIES---			
		A. TLM - CCS	PRELAUNCH	MANDATORY	A. TO PROVIDE TM FOR DETERMINING S-IVB STATUS BEYOND VHF RANGE.
		B. CMD - CCS	PRELAUNCH	MANDATORY	B. TO PROVIDE CORRECTIVE COMMAND CAPABILITY FOR S-IVB BULKHEAD DELTA PROBLEMS.
					C. BOTH OF THE ABOVE ARE REQUIRED TO INSURE CREW SAFETY AND LM EXTRACTION.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	4-15	HSK, GDS, MAD			
		IT IS MANDATORY 2 OF 3 OF THESE SITES PROVIDE THE FOLLOWING CAPABILITIES---			
		A. TM USB	PRELAUNCH	MANDATORY	A. TO COVER TRANSLUNAR COAST AND LPO.
		B. TRACK USB	PRELAUNCH	MANDATORY	
		C. VOICE USB	PRELAUNCH	MANDATORY	
		D. CMD USB	PRELAUNCH	HIGHLY DESIRABLE	
	4-16	RIOMETER NETWORK SITES	PRELAUNCH		
		A. LIMA		HIGHLY DESIRABLE	
		B. CRO CYI		1 OF 2 HIGHLY DESIRABLE	

R	ITEM	
	4-17	INTRODUCTION TO SITE FAILURE DECISION MATRIX FOR PRELAUNCH FAILURES OF LAUNCH PHASE SITE CAPABILITY, THE FOLLOWING DECISION MATRIX APPLIES THE LAUNCH PHASE GROUND INSTRUMENTATION REQUIREMENTS TO THE RESULTING DEGRADED COVERAGE. THIS MATRIX POINTS OUT THE LOSS OF CONTINUOUS COVERAGE BETWEEN LIFTOFF AND INSERTION PLUS 60 SECONDS FOR VARIOUS SITE FAILURES. IF SITE FAILURES OCCUR PRIOR TO LAUNCH, THE MATRIX WILL BE USED TO DETERMINE WHETHER MANDATORY CONTINUOUS COVERAGE HAS BEEN LOST. (NOMINAL INSERTION IS 12 + 40) TO USE THE MATRIX A. LOOK FOR AN X UNDER THE COLUMN FOR SITE WHERE THE FAILURE OCCURRED. B. GO ACROSS TO THE COLUMN FOR THE CAPABILITY THAT WAS LOST AND READ THE DECISION. C. THE COVERAGE THAT WAS LOST IS IN THE COLUMN LABELED ''APPROXIMATE MANDATORY COVERAGE LOST''. D. MORE THAN ONE X IN A ROW SPECIFIES A FAILURE OF THE SAME CAPABILITY AT MORE THAN ONE SITE.

R | ITEM

	SITES FAILED				APPROXIMATE MANDATORY COVERAGE LOST FOR NO/GO ITEMS FOR ALL LAUNCH AZIMUTHS	CAPABILITY LOST			
	ALDS TM	MIL/CAPE	BDA	VAN		TELEMETRY	CMD	TRACK	A/G
	00-00 TO 08-49	00-00 TO 08-49	04-10 TO 12-40	09-10 TO 16-05		USB OR CCS AND VHF	USB AND CCS	BOTH S AND C BAND	USB AND VHF
SINGLE SITE FAILURE	X				NONE SEE NOTE 1	GO	N/A	N/A	N/A
		X			00-00 TO 04-10 SEE NOTE 2	GO	GO	NO-GO	NO-GO
			X		08-49 TO 09-10 SEE NOTE 3	GO	GO	GO	GO
				X	NONE	GO	GO	GO	GO
MULTIPLE SITE FAILURES	X	X			00-00 TO 04-10	NO-GO	GO	NO-GO	NO-GO
		X	X		00-00 TO 09-10 SEE NOTE 2	GO	GO	NO-GO	NO-GO
		X		X	00-00 TO 04-10 SEE NOTE 2	GO	GO	NO-GO	NO-GO
			X	X	08-49 TO 16-05	NO-GO	GO	NO-GO	NO-GO
	X		X		08-49 TO 09-10 SEE NOTE 3	GO	GO	GO	GO
	X			X	NONE	GO	GO	GO	GO
	X	X	X		00-00 TO 09-10	NO-GO	GO	NO-GO	NO-GO

NOTES---

1. LOSS OF ALDS RESULTS IN LOSS OF S-IC TM, HOWEVER, IT IS NOT MANDATORY FOR LAUNCH.
2. GO ON TM BECAUSE OF ALDS DATA UNTIL 08-49.
3. LOSS OF COVERAGE IS NOT SEVERE ENOUGH FOR A NO-GO CONDITION.

5 TRAJECTORY AND GUIDANCE

R	ITEM	
	5-1	THE LAUNCH PHASE WILL BE TERMINATED FOR ANY OF THE FOLLOWING CONDITIONS--- A. VIOLATION OF THE VEHICLE BREAKUP LINE. B. TFF IS LESS THAN OR EQUAL TO 1 + 40 AND DECREASING AFTER TOWER JETTISON. C. VIOLATION OF ENTRY "G" LIMIT. D. VS INCREASING. E. OVERSPEED CONDITIONS AT INSERTION. F. VIOLATION OF EXIT HEATING LINE. G. IF SLV-S/C VIOLATES THE MINIMUM MODE III BURN LINE BEFORE ACHEIVING MODE IV CAPABILITY.
	5-2	THE LES WILL NOT BE JETTISONED UNTIL MODE II CAPABILITY IS ESTABLISHED BY TFF IS GREATER THAN OR EQUAL TO 1 + 20 AND INCREASING.
	5-3	MODE II, III, IV, AND APOGEE KICK. A. THE GROUND IS PRIME FOR ABORT MODE DETERMINATION AND MODE III MANEUVER COMPUTATION. THE CREW USING THE G AND N, WILL BE PRIME FOR MODE IV, APOGEE KICK MANEUVERS, AND DETERMINATION OF S-IVB OVERSPEED CONDITIONS. B. MANEUVERS WILL BE INTERRUPTED WHEN TFF = 1 + 40 AND DECREASING. C. MODE IV MANEUVERS WILL BE INTERRUPTED IF THE CURRENT ALTITUDE IS 75 NM, DECREASING AND HP IS LESS THAN 300K FT. D. IF ENTERING, UTILIZE LIFT TO AVOID LAND. UNAVOIDABLE LAND LANDING USE RL 90 DEG. E. IF NO SLA SEP OR IF SPS FAILS--- 1. HP IS LESS THAN 40 - EXECUTE CM/SM SEP BY TFF = 1 + 40. 2. HP IS BETWEEN 40 AND 75 - GROUND WILL DECIDE TO USE SM RCS ASAP OR AT APOGEE TO REDUCE HP TO 40 NM.
	5-4	MODE III ABORTS. A. PREDICTED TFF AFTER SPS C/O IS LESS THAN 1 + 40. 1. FULL LIFT IP ON WATER - DO NOT BURN. 2. G&N GO AND FULL LIFT IP ON LAND - BURN TO TFF = 1 + 40, RL 90 DEG. 3. G&N NO-GO AND FULL LIFT IP ON LAND - BURN A REDUCED DELTA V TO MAINTAIN TFF AFTER C/O AND RL 90 DEG. B. IF DELTA TB IS LESS THAN OR EQUAL TO 2 SEC, DO NOT BURN. C. IF IGNITION OCCURS AFTER GETI +10 SEC, BURN UNTIL G&N DELTA R = 0, RL 55 DEG. (IF UNABLE TO BURN DELTA R = 0, RL 90 DEG.)

R	ITEM	
	5-5	THE S/C CMC WILL BE NO-GO FOR ABORT MANEUVER DETERMINATION AND MONITORING FOR ANY OF THE FOLLOWING--- A. CMC PROGRAM ALARMS--- SINGLE OCCURRENCE - 00214, 00777, 01107, 01407, 04777, 07777, 10777, 13777, 14777, 00205 CONTINUOUS OCCURRENCE - 20430, 20607, 20610, 21103, 21204, 21206, 21210, 21302, 21501, 21502, 21521, 31104, 31201, 31202, 31203, 31207, 31211 B. RTCC AND CMC TFF DIFFERENCE OF GREATER THAN 40 SEC. C. CONFIRMED ERROR IN S/C PLATFORM VELOCITY COMPONENTS OF GREATER THAN 50 FPS IN X OR 100 FPS IN Z. D. CMC TRAJECTORY SOURCE INDICATES ''GO'' OR ''NO-GO'' INCONSISTENT WITH BEST TRAJECTORY SOURCE(S) INDICATION.
	5-6	THE ORBIT IS ''GO'' IF HP IS GREATER THAN OR EQUAL TO 75 NM.
		RULES 5-7 THROUGH 5-19 ARE RESERVED.

R	ITEM	
	5-20	EARTH ORBITAL ALTITUDE CONSTRAINTS--- A. REAL-TIME MISSION PLANNING PERIGEE - 85 NM MINIMUM. MAXIMUM HP IS DETERMINED BY SM RCS AVAILABLE FOR HYBRID DEORBIT. B. CONTINGENCY PERIGEE - 75 NM MINIMUM (VIOLATIONS WILL BE CORRECTED ASAP) IF HP LESS THAN 75 NM AND MANEUVER TO RAISE HP IS NOT POSSIBLE--- 1. HP IS BETWEEN 40 AND 75 - EXECUTE SPS RETROGRADE ASAP UNTIL HP IS LESS THAN 40. IF NO SPS, USE SM-RCS. 2. HP IS LESS THAN 40 - CM/SM SEP - RETRO WILL RECOMMEND ENTRY PROFILE.
	5-21	RESERVED
	5-22	S/C L/O TIME (GRR) WILL BE UPDATED WITH SRO L/O TIME IF THE TWO ARE DIFFERENT BY 10 SEC.
	5-23	TIME BETWEEN EPO RETROFIRE GETI AND 400K MUST BE GREATER THAN 9 MIN. IF NOT, RETARGET FOR NEXT PTP.
	5-24	RESERVED
	5-25	PLANNED G&N AND SCS RETROFIRE MANEUVERS WILL BE UPDATED IF--- A. THE COMPUTED RETROFIRE POSITION CHANGES BY GREATER THAN 0.5 DEG LONGITUDE PRIOR TO GETI -30 MIN. B. THE COMPUTED RETROFIRE POSITION CHANGES BY GREATER THAN 2 DEG LONGITUDE AFTER GETI -30 MIN.

R	ITEM	
	5-26	RESERVED
	5-27	IF SPS FAILS AFTER EPO RETROFIRE IGNITION OR NO SLA SEP--- A. HP IS GREATER THAN 75 NM - RETARGET FOR NEXT BEST PTP USING RCS. B. HP BETWEEN 40 AND 75 - PITCH UP TO LOCAL HORIZONTAL ATTITUDE AND BURN SM RCS USING FOLLOWING PRIORITIES--- 1. BURN HP TO PAD VALUE 2. BURN MAXIMUM SM RCS DELTA V AVAILABLE 3. BURN CM RCS TO HP = 40 NM IF SM RCS DELTA V NOT SUFFICIENT TO OBTAIN HP = 40 NM IF HP IS LESS THAN OR EQUAL TO 40 NM TERMINATE ALL THRUSTING AT TFF = 7 MIN. C. HP IS LESS THAN 40 NM - REMAIN IN RETRO ATTITUDE AND BURN SM RCS USING THE FOLLOWING PRIORITY--- 1. BURN DELTA V RISIDUALS. 2. BURN MAXIMUM SM DELTA V AVAILABLE. NOTE THE S-IVB LOX DUMP CAPABILITY MAY BE USED TO SHAPE THE ORBIT FOR RETROFIRE MANEUVER OR TO REDUCE THE S-IVB WEIGHT TO OBTAIN MORE SM RCS DELTA V.

R	ITEM	
	5-28	THE G&N IS NO-GO FOR ENTRY IF--- A. THE CMC VALUE OF DOWNRANGE ERROR (RP - RT) AT .2G DIFFERS GREATER THAN +/- 100 NM FROM GROUND VALUE. CREW FAILOVER TO EMS ENTRY AS FIRST PRIORITY OR GROUND BANK ANGLE AND RETRB AS SECOND PRIORITY. B. V AND GAMMA AT 400K ARE OUTSIDE THE CORRIDOR. GROUND WILL PROVIDE ENTRY PROFILE.
	5-29	BOOSTER NAVIGATION AND TARGET UPDATES FOR TLI--- A. AN IU NAVIGATION UPDATE WILL BE PERFORMED FOR THE FOLLOWING SITUATIONS. THE UPDATE WILL BE TIMETAGGED PRIOR TO LOS OF THE LAST SITE PRIOR TO TB6 INITIATION. 1. WHERE AN IU ACCELEROMETER FAIL OCCURRED PRIOR TO EARTH ORBIT INSERTION. 2. FOR A FIRST OR SECOND TLI OPPORTUNITY WHERE MSFN VERSUS IU DIFFERENCE VIOLATES ANY OF THE FOLLOWING--- AT GET = 56 MIN--- DOWNRANGE POSITION GREATER THAN +/- 87801 FT SEMI-MAJOR GREATER THAN +/- 3.1 NM CROSSRANGE VELOCITY GREATER THAN +/- 16 FPS AT GET = 1 HR 45 MIN--- DOWNRANGE POSITION GREATER THAN +/- 181468 SEMI-MAJOR AXIS GREATER THAN +/- 3.5 NM CROSSRANGE VELOCITY GREATER THAN +/- 16 FPS B. THERE WILL BE NO IU TARGET UPDATES FOR EITHER TLI OPPORTUNITY.
	5-30	RESERVED
	5-31	RESERVED
	5-32	THE MAXIMUM ALLOWABLE MISALIGNMENT RATES BETWEEN THE IU AND IMU ARE 0.6 DEG/HR (IU) AND 1.5 DEG/HR (IMU).
	5-33	RESERVED
	5-34	DISPERSED TLI C/O--- PREDICTED DELTA V CAPABILITY (CSM ALONE) AFTER TD&E AND DOCKED SPS MIDCOURSE--- A. GREATER THAN 5500 FPS - CONTINUE MISSION B. LESS THAN 5500 FPS - EXECUTE EARTH ORBIT ALTERNATE

R	ITEM	
	5-35	DIFFERENCE IN CMC AND IU PLATFORM VELOCITY COMPONENTS OR TOTAL VELOCITY AT INSERTION--- A. VIOLATION OF ANY OF THE FOLLOWING MEANS TLI IS NO-GO--- DELTA XDOT IS GREATER THAN +/- 38 FPS DELTA YDOT IS GREATER THAN +/- 73 FPS DELTA ZDOT IS GREATER THAN +/- 87 FPS DELTA VT IS GREATER THAN +/- 34 FPS B. VIOLATION OF ANY OF THE FOLLOWING MEANS TLI IS TEMPORARILY NO-GO--- DELTA XDOT IS BETWEEN +/- 7.5 AND +/- 38 FPS DELTA YDOT IS BETWEEN +/- 41 AND +/- 73 FPS DELTA ZDOT IS BETWEEN +/- 28 AND +/- 87 FPS DELTA VT IS BETWEEN +/- 14 AND +/- 34 FPS NOTE TLI IS NO-GO UNTIL PARTS C AND 5-36 ARE DETERMINED (ORBITAL PARAMETER DECISIONS). C. VIOLATION OF ANY OF THE FOLLOWING ORBITAL DECISION PARAMETERS AT GET = 1 HR 45 MIN MEANS TLI IS NO-GO. PARAMETERS ARE IU VERSUS MSFN. SEMI-MAJOR AXIS IS GREATER THAN +/- 3.28 NM CROSSRANGE VELOCITY IS GREATER THAN +/- 32 FPS
	5-36	DIFFERENCE IN MSFN AND IU DOWNRANGE POSITION (DELTA RV) IS GREATER THAN +/- 105,100 FT AT GET = 56 MIN MEANS TLI IS NO-GO.
	5-37	WITH AN S-IVB GUID REF FAIL OR AN S-IVB ACCELEROMETER FAIL DURING LAUNCH PHASE, VIOLATION OF ANY OF THE FOLLOWING ORBITAL DECISION PARAMETERS MEANS TLI IS NO GO. PARAMETERS ARE CMC VERSUS MSFN. A. DIFFERENCE IN DOWNRANGE POSITION IS GREATER THAN +/- 535,900 FEET AT GET = 56 MIN. B. DIFFERENCE IN SEMIMAJOR AXIS IS GREATER THAN +/- 11.6 N. MI AT GET = 1 HR 45 MIN. C. DIFFERENCE IN CROSSRANGE VELOCITY IS GREATER THAN +/- 78.7 FPS AT GET = 1 HR 45 MIN.
		RULES 5-38 THROUGH 5-45 ARE RESERVED.

R	ITEM	
	5-46	THE CMC OR LGC WILL BE TEMPORARILY NO-GO FOR MANEUVER CONTROL FOR ANY OF THE FOLLOWING---

A. COMPUTER PROGRAM ALARMS---

SINGLE OCCURRENCE - 00205, 00214, 00777, 01107, 01407, 03777, 04777, 07777, 10777, 13777, 14777

CONTINUOUS OCCURRENCE - 20430, 20607, 20610, 21103, 21204, 21206, 21210, 21302, 21501, 21502, 21521, 31104, 31201, 31202, 31203, 31207, 31211

B. CMC/IMU ALIGNMENT DISCREPANCY (FOR MANEUVER EXECUTION, MONITORING, AND ORBIT DETERMINATION).

1. SEXTANT STAR CHECK--- AUTO OPTICS POSITIONING DOES NOT PLACE SELECTED STAR IN FIELD OF VISION OF SXT.

2. HORIZON CHECK ERROR IS GREATER THAN 4 DEG FOR RETROFIRE FROM EPO.

C. LGC/IMU ALIGNMENT DISCREPANCY INDICATE BY GREATER THAN 2 DEG FROM PREDICTED COAS COORDINATES.

D. DIFFERENCE BETWEEN CMC/LGC GROUND NAV CHECK AFTER A NAV UPDATE FROM GROUND IS---

1. LATITUDE IS GREATER THAN .02 DEG.

2. LONGITUDE IS GREATER THAN .02 DEG.

3. H IS GREATER THAN .2 NM.

5-47 SPACECRAFT TIMING MUST BE MAINTAINED WITHIN THE LIMITS---

	CMC (SEC)	LGC (SEC)	AGS (SEC)
A. RETROFIRE	2	---	---
B. ENTRY	2	---	---
C. TLI	2	---	---
D. MCC'S	2	---	---
E. LOI/DOI	2	2	---
F. TEI	2	2	---
G. DESCENT	.5	.3	.3
H. ASCENT	.5	.3	.3
I. RENDEZVOUS	.5	.5	.5
J. SXT TRACKING	.5	---	---

RULES 5-48 THRU 5-55 ARE RESERVED.

R	ITEM	
		APOLLO 14 FNL 11/1/70 TRAJECTORY TRANSLUNAR
	5-56	RESERVED
	5-57	TRANSLUNAR MCC EXECUTION CRITERIA A. SPS MCC'S SHOULD BE GREATER THAN 3 SEC. B. MCC 2 AND 4 ARE PREFERRED EXECUTION POINTS. C. CONSIDERING THE ABOVE, FIRST MIDCOURSE WILL BE DELAYED UNTIL MCC 2 IF COST IS NOT PROHIBITIVE. D. IF THE NOMINAL MISSION DESIGN IS FREE RETURN, A NON-FREE MCC 2 OF 3 SEC SPS WILL BE EXECUTED TO AVOID MCC 3 WHEN FEASIBLE. E. FOR A NOMINAL HYBRID MISSION, THE MANEUVER TO GO NON-FREE RETURN WILL BE EXECUTED AT MCC 2.
	5-58	RESERVED
	5-59	LOI SHALL BE TARGETED WITHIN THESE CONSTRAINTS--- A. THE PERICYNTHION OF THE APPROACH HYPERBOLA WILL BE MAINTAINED WITHIN +/- 10 N.M. OF HP - TARGET. B. THE ALTITUDE OF THE NODE (BETWEEN THE APPROACH HYPERBOLA AND THE DESIRED LPO) WILL BE MAINTAINED BETWEEN -10 AND +15 N.M. OF HP TARGET.
	5-60	A ''GO'' FOR LOI REQUIRES THE FOLLOWING--- A. COMMITMENT TO LEAST 4 HRS IN LPO - (PROVIDES ONE REV OF TRACK AFTER LOI FOR CALCULATION OF TEI). B. ADEQUATE FUEL REMAINING FOR SUBSEQUENT LUNAR ORBIT OPERATIONS. (MINIMUM IS TEI AND TEC MCC'S)

R	ITEM	
	5-61	PREMATURE LOI SHUTDOWN FOR SPS PROBLEMS (LOI ABORT MODES)

A. SHUTDOWN IN MODE 1 REGION -

1. EXECUTE A DPS 2 HR DIRECT ABORT FOR

LOI BURN TIME FROM 0 TO 33 SEC.

LOI DELTA V FROM 0 TO 238

2. EXECUTE A DPS 30 MIN DIRECT ABORT FOR

LOI BURN TIME FROM 33 SEC TO 1+15

LOI DELTA V FROM 238 TO 545

3. EXECUTE A DPS TO DEPLETION 30-MIN DIRECT ABORT FOLLOWED BY A SUPPLE MENTARY APS BURN 2 HRS LATER

LOI BURN TIME FROM 1+15 TO 1+39

LOI DELTA V FROM 545 TO 725

B. SHUTDOWN IN MODE II REGION - EXECUTE A DPS 2-IMPULSE CIRCUMLUNAR ABORT.

LOI BURN TIME FROM 1+39 TO 2+41

LOI DELTA V FROM 725 TO 1202

C. SHUTDOWN IN MODE III REGION - EXECUTE TEI (SPS OR DPS) AT NEXT OPPORTUNITY OR INITIATE AN ALTERNATE MISSION.

LOI BURN TIME FROM 2+41 TO 6+07

LOI DELTA V FROM 1202 TO 2986

NOTE---

1. ALL ABORT MANEUVERS ARE MCC-H TARGETED EXCEPT FOR THE DPS 30-MIN ABORT WHICH IS TAKEN FROM THE CREW CHART

2. CONTROL LIMITS APPLY AS FOLLOWS---

LOI DELTA TB	LOI DELTA V	LIMITS
0 - 33 SEC	0 - 238	TIGHT
33 SEC-3+20	238 - 1513	LOOSE
3+20 - C/O	1513 - 2986	TIGHT

5-62 IF THE SPS FAILS AT IGNITION---

A. MCC - RESCHEDULE MCC FOR FLYBY TRAJECTORY WITH DPS/SM-RCS EXECUTION.

B. LOI - EXECUTE ABORT MANEUVER WITH DPS/SM-RCS.

C. DOI - EXECUTE GROUND COMPUTED TEI WITH DPS AS SOON AS PRACTICAL.

RULES 5-63 THROUGH 5-75
ARE RESERVED.

R	ITEM	
	5-76	THE DOI MANEUVER WILL BE TARGETED TO ACHIEVE A 50K FT PERICYNTHIAN AT PDI.
	5-77	A ''GO'' FOR DOI REQUIRES COMMITMENT TO AT LEAST 4 HRS IN LUNAR ORBIT. (NOTE--- THIS PROVIDES ONE FULL REV OF TRACK AFTER DOI FOR CALCULATION OF TEI.)
	5-78	AFTER AOS, FOLLOWING DOI, EXECUTION OF THE BAILOUT ABORT MANEUVER WILL BE RECOMMENDED IF INCOMING MSFN RADAR DATA INDICATES A CLOSEST APPROACH ALTITUDE OF EQUAL TO OR LESS THAN 1.0 N.M. ABOVE THE LUNAR TERRAIN. NOTE 1. THE PERICYNTHION ALTITUDE WHICH CORRESPONDS TO 1.0 N.M. CLOSEST APPROACH IS 3.6 N.M. 2. THE VALUE OF DOPPLER RESIDUALS AT AOS WHICH CORRESPONDS TO THIS PERICYNTHION IS -32 CYCLES PER SECOND.
		RULES 5-79 THROUGH 5-80 ARE RESERVED.

R	ITEM	
	5-81	PRIOR TO UNDOCKING, CSM MANEUVERS WILL BE SCHEDULED ASAP TO CORRECT THE FOLLOWING SITUATIONS--- A. MISS DISTANCE OVER THE LLS GREATER THAN 0.5 DEG OUT OF PLANE. B. DEVIATION IN APPROACH AZIMUTH GREATER THAN +/- 2 DEG FROM THE NOMINAL. C. CURRENT PERICYNTHION ALTITUDE LESS THAN 30000 FT. D. PREDICTED ALTITUDE AT PDI IGNITION LESS THAN 30000 FT OR GREATER THAN 70000 FT. (PREDICTIONS WILL BE BIASED USING EXPECTED/CALCULATED WORST CASE PROPOGATION ERRORS). NOTE WHEN POSSIBLE ANY REQUIRED MANEUVER(S) WOULD BE SCHEDULED SHORTLY AFTER CREW WAKE-UP ON PDI DAY.
	5-82	AN UPDATE TO THE LLS WILL BE PROVIDED THE CREW DURING PDI TO CORRECT ANY DOWNRANGE ERRORS THAT HAVE ACCUMULATED IN THE LGC ESTIMATE OF POSITION PROVIDING THIS UPDATE IS NO LESS THAN 1000 FT. NOR MORE THAN 35,000 FT.
	5-83	THE CIRCULARIZATION MANEUVER WILL BE TARGETED TO ACHIEVE A 60 N.M. CIRCULAR ORBIT AT RENDEZVOUS.
	5-84	THE PREMISSION LLS POSITION WILL BE UPDATED IF THE LLS SXT SIGHTINGS CHANGE BY--- A. FRA MAURO 1. DELTA H LESS THAN 2000 FT. 2. DELTA LATITUDE LESS THAN 6000 FT. 3. DELTA LONGITUDE LESS THAN 2000 FT.
	5-85	ALLOWABLE MISALIGNMENTS AT PDI ARE 0.6 DEG ABOUT THE X AND Y AXES. IF THE SECOND P52 ALIGNMENT DETECTS DRIFT RATES INDICATIVE OF GREATER MISALIGNMENT, PDI WILL BE SLIPPED ONE REV.
		RULES 5-86 THROUGH 5-88 ARE RESERVED.

R	ITEM	
	5-89	LR DATA IS REQUIRED FOR LANDING--NO LR DATA BY 10K FT -ABORT. A. LR CONVERGENCE (ALTITUDE ONLY) - DATA NOT BEING ACCEPTED OR CONVERGING FOLLOWING LOCKON FOR 60 SECONDS - ABORT. B. LR DATA ACCEPTED AND CONVERGED CONTINUOUS TO P-64 - CONTINUE MISSION IF LOSS OF LOCK OCCURS IN P-64. C. LR DATA ACCEPTED AND CONVERGED WITH SUBSEQUENT DROPOUT - CONTINUE TO P-64. 1. LANDING RADAR REGAINED IN P-64. (A) DELTA H LESS THAN 1000FT BETWEEN PGNS AND LR - CONTINUE MISSION. (B) DELTA H GREATER THAN 1000 FT BETWEEN PGNS AND LR - ATTEMPT MANUAL LANDING IN AGS. 2. LR NOT REGAINED AT P-64 - ABORT. D. LATE LR LOCKON WITH DATA BEING INCORPORATED AND CONVERGING - CONTINUE TO P-64. 1. DELTA H LESS THAN 1000 FT BETWEEN PGNS AND LR - CONTINUE MISSION. 2. DELTA H GREATER THAN 1000 FT BETWEEN PGNS AND LR - ATTEMPT MANUAL LANDING IN AGS.
	5-90	A. POWERED DESCENT WILL BE TERMINATED FOR--- 1. PGNS ALTITUDE LESS THAN 22,000 FEET AND PNGS NAVIGATION ERRORS, CONFIRMED BY MSFN OR DOPPLER RESIDUALS, THAT CAUSE THE AGS-PGNS RADIAL VELOCITY DIFFERENCE TO EXCEED MINUS 10 FPS, PRIOR TO LANDING RADAR ALTITUDE INCORPORATION AND CONVERGENCE (A MINUS VELOCITY DIFFERENCE INDICATES THAT THE AGS TRAJECTORY IS LOWER THAN THE PNGS TRAJECTORY). 2. PNGS NAVIGATION ERRORS, CONFIRMED BY MSFN OR DOPPLER RESIDUALS, THAT RESULT IN THE FOLLOWING AGS-PNGS VELOCITY DIFFERENCES--- DELTA X DOT (DOWNRANGE) GREATER THAN +/- 45 FPS DELTA Y DOT (CROSSRANGE) GREATER THAN +/- 90 FPS DELTA Z DOT (RADIAL) GREATER THAN +/- 35 FPS 3. PGNS ALTITUDE LESS THAN 18,000 FEET AND PNGS NAVIGATION ERRORS, CONFIRMED BY DOPPLER BUT NOT BY AGS, CAUSE THE MSFN-PGNS RADIAL VELOCITY DIFFERENCE TO EXCEED MINUS 20 FPS PRIOR TO LANDING RADAR ALTITUDE INCORPORATION AND CONVERGENCE. 4. PNGS NAVIGATION ERRORS CONFIRMED BY DOPPLER RESIDUALS BUT NOT BY AGS, THAT RESULT IN THE FOLLOWING MSFN-PNGS VELOCITY DIFFERENCES--- DELTA Y DOT (CROSSRANGE) GREATER THAN +/- 200 FPS. DELTA Z DOT (RADIAL) GREATER THAN +/- 35 FPS. NOTE---RULES 2 AND 4 ARE INDEPENDENT OF ANY TYPE OF LANDING RADAR UPDATE. FOR RULES 1 AND 2, SWITCHOVER TO AGS WILL BE PERFORMED. 5. COMMANDED THRUST INCREASING PRIOR TO THROTTLE DOWN OR P63 TGO=80 SEC. 6. RESERVED 7. NO THROTTLE RECOVERY BY P63/664 PROGRAM SWITCH PLUS 15 SEC. 8. FAILURE TO ACHIEVE FTP BY NOMINAL TIG +31 SEC. (ABORT AT GTC DIVERGENCE). 9. FAILURE TO ENTER P64 WHEN TGO EQUALS 60 SECONDS. 10. THE FOLLOWING PNGS ALARMS---20105, 00214, 20430, 20607, 21103, 01107, 21204, 21302, 21501, 00402 (CONTINUING). B. POWERED DESCENT MANEUVER WILL BE TERMINATED AND AN ABORT REQUESTED IF THE TIME BIASED DPS ABORT BOUNDARY IS VIOLATED.
	5-91	AN ABORT WILL NOT BE REQUESTED FOR A PNGS FAILURE AFTER A PNGS INDICATION THAT THE HIGH GATE TARGETING CONDITIONS HAVE BEEN ACHIEVED.

R	ITEM	
	RULES	5-92 THROUGH 5-100 ARE RESERVED.

R	ITEM	
	5-101	LM LIFTOFF WILL BE DELAYED ONE REVOLUTION RATHER THAN ACCEPTING A SLIP IN NOMINAL LIFTOFF TIME GREATER THAN A. 10 SECONDS FOR THE SHORT RNDZ TECHNIQUE B. 90 SECONDS FOR THE COELLIPTIC SEQUENCE RNDZ
	5-102	FOLLOWING A DESCENT ABORT, GUIDANCE SWITCHOVER TO AGS WILL BE PERFORMED FOR--- A. THE FOLLOWING PGNS ALARMS--- 20105, 00214, 20430, 20607, 21103, 01107, 21204, 21302, AND 21501 B. PGNS NAVIGATION ERRORS THAT RESULT IN--- 1. AGS PREDICTED INSERTION HP LESS THAN 40,000 FEET. 2. AGS PREDICTED INSERTION HA GREATER THAN TARGET VALUE PLUS 40 NAUTICAL MILES. 3. AGS PREDICTED INSERTION WEDGE ANGLE GREATER THAN 1.0 DEGREE.
	5-103	DURING ASCENT, GUIDANCE SWITCHOVER TO AGS WILL BE PERFORMED FOR--- A. THE FOLLOWING PGNS ALARMS--- 20105, 00214, 20430, 20607, 21103, 01107, 21204, 21302, AND 21501 B. PNGS NAVIGATION ERRORS, CONFIRMED BY AGS RESIDUALS, THAT RESULT IN THE FOLLOWING MSFN-PNGS VELOCITY DIFFERENCES--- DELTA X DOT (DOWNRANGE) GREATER THAN +/- 24 FPS DELTA Y DOT (CROSSRANGE) GREATER THAN +/- 90 FPS (COELLIPTIC SEQUENCE RENDEZVOUS) GREATER THAN +/- 45 FPS (SHORT RENDEZVOUS) DELTA Z DOT (RADIAL) GREATER THAN +/- 37 FPS C. PGNS NAVIGATION ERRORS THAT RESULT IN--- 1. AGS PREDICTED INSERTION HP LESS THAN 40,000 FEET. 2. AGS PREDICTED INSERTION HA GREATER THAN TARGET VALUE PLUS 40 NAUTICAL MILES. 3. AGS PREDICTED INSERTION WEDGE ANGLES GREATER THAN 1.0 DEGREE (COELLIPTIC SEQUENCE RENDEZVOUS) GREATER THAN 0.5 DEG (SHORT RENDEZVOUS) D. IF MSFN NOT VALID DURING ASCENT THE FOLLOWING DOPPLER RESIDUALS WILL BE USED TO CONFIRM SWITCHOVER--- 1. AGS - PGNS DELTA X DOT (DOWNRANGE) GREATER THAN +/- 24 FPS AND DOPPLER - PGNS RESIDUAL GREATER THAN 10 FPS. 2. AGS - PGNS DELTA Z DOT (RADIAL) GREATER THAN +/- 37 FPS AND DOPPLER - PGNS RESIDUAL GREATER THAN 33 FPS.

R	ITEM	
	5-104	DURING ASCENT, THE AGS WILL BE DECLARED NO-GO FOR CONFIRMED AGS NAVIGATION ERRORS THAT RESULT IN--- A. PGNS PREDICTED INSERTION HP LESS THAN 30,000 FT. B. PGNS PREDICTED INSERTION HA GREATER THAN TARGET VALUE PLUS 40 N.M. C. PGNS PREDICTED INSERTION WEDGE ANGLE GREATER THAN 1.0 DEGREE (COELLIPTIC SEQUENCE RENDEZVOUS) GREATER THAN 0.5 DEG (SHORT RENDEZVOUS)
	5-105	THE GROUND WILL NOT REQUEST SWITCHOVER AFTER AGS TGO LESS THAN 30 SEC.
		RULES 5-106 THRU 5-110 ARE RESERVED.

R	ITEM	
	5-111	THE PGNS IS PRIME FOR EITHER THE SHORT RNDZ (TPI ONLY) OR THE COELLIPTIC SEQUENCE (CSI, CDH, AND TPI) MANEUVER COMPUTATION/EXECUTION WITH THE AGS AS BACKUP UTILIZING THE ACCEPTED SOLUTION. THE AVAILABLE SOLUTIONS FOR THESE MANEUVER(S) ARE, (IN ORDER OF PRIORITY) PGNS, AGS, CMC, AND CHARTS. A. THE FOLLOWING VOTING LOGIC WILL BE OBSERVED FOR ALL MANEUVERS--- 1. IF VHF AND RR AGREES - VOTE 2 OUT OF 3 SOURCES AND EXECUTE THE PRIORITY SOLUTION 2. IF VHF AND RR DISAGREE - MSFN WILL BE UTILIZED TO ISOLATE THE FAILED SYSTEM B. AGREEMENT BETWEEN SOURCES IS DEFINED AS--- 1. SHORT RNDZ - TPI--- 3 FPS IN DELTA VX, 7 FPS IN DELTA VY, 9 FPS IN DELTA VZ (NOTE--- LM BIASES OF +1 FPS IN DELTA VX AND -2 FPS IN DELTA VZ WILL BE APPLIED TO THE LM SOLUTION FOR COMPARISON WITH THE CSM SOLUTION) 2. COELLIPTIC SEQUENCE RNDZ A. CSI - 3 FPS IN DELTA VX B. CDH - 2 FPS IN DELTA VX, 6 FPS IN DELTA VZ C. TPI - 2 FPS IN DELTA VX, 5 FPS IN DELTA VY, 6 FPS IN DELTA VZ C. THE CMC SOLUTION FOR THE PLANE CHANGE MANEUVER WILL ALWAYS BE EXECUTED IF GREATER THAN 5 FPS.
	5-112	LIFTOFF WILL BE COMPUTED TO SATISFY THE FOLLOWING CONSTRAINTS--- A. SHORT RNDZ 1. THE DELTA H AT TPI WILL BE 15 NM. 2. THE DELTA θ AT TPI WILL BE + 1.69 DEG. 3. TPI WILL OCCUR 38 AFTER INSERTION 4. THE WEDGE ANGLE AT INSERTION WILL BE ZERO DEGREES. B. COELLIPTIC SEQUENCE RNDZ. 1. THE DELTA H AT TPI WILL BE 15 NM. 2. THE NOMINAL ELEVATION ANGLE (26.6) DEG WILL OCCUR 16 MIN PRIOR TO SUNRISE. 3. THE CDH MANEUVER WILL BE APPROXIMATELY ZERO DELTA V
	5-113	COELLIPTIC SEQUENCE RNDZ EXECUTION SHALL, WHERE POSSIBLE, OBSERVE THE FOLLOWING CONSTRAINTS-- A. THE ACTUAL DELTA H MAY BE SLIPPED +/- 5 NM. FROM 15 NM. B. TPI MAY OCCUR NO EARLIER THAN 31 MIN. PRIOR TO SUNRISE C. THE DELTA T BETWEEN CDH AND TPI MUST BE GREATER THAN 30 MIN.

R	ITEM	
	5-114	THE 'BAILOUT' MANEUVER TO TRANSFER FROM THE SHORT RNDZ TECHNIQUE TO THE COELLIPTIC SEQUENCE RNDZ WILL BE EXECUTED IF--- A. THE DELTA VG OF THE TWEAK MANEUVER BECOMES GREATER THAN 60 FPS. B. EXECUTION OF THE TWEAK WOULD RESULT IN A LM PERILUNE OF LESS THAN 5 NM.
	5-115	TWO INDEPENDENT METHODS OF RNDZ NAVIGATION ARE REQUIRED TO COMMIT TO THE SHORT RNDZ. THE ACCEPTABLE RNDZ NAVIGATION TECHNIQUES ARE 1. LGC AND RNDZ RADAR 2. AEA AND RNDZ RADAR 3. AEA, VHF_{EMS}, LM COAS AND CSM LIGHT 4. CMC, SEXTANT, AND LM LIGHT 5. CMC, VHF_{CMC}, SEXTANT, AND REFLECTED SUNLIGHT 6. CMC, VHF_{CMC}, CSM COAS, AND LM LIGHT 7. CMC, VHF_{CMC}, CSM COAS, AND REFLECTED SUN LIGHT RULES 5-116 THROUGH 5-120 ARE RESERVED.

R	ITEM	
	5-121	RESERVED
	5-122	RESERVED
	5-123	TEC MCC FOR LANDING AREA CONTROL--- A. PRIOR TO EI-24 HRS---WILL BE EXECUTED FOR RECOVERY ACCESS VIOLATIONS, UNACCEPTABLE WEATHER AT IP, OR IF THERE IS ANY LAND MASS IN THE G+N EMS, OR CONSTANT G LANDING AREAS OR IF A SIGNIFICANT LAND MASS IS IN ANY OTHER PORTION OF THE OPERATIONAL FOOTPRINT. B. AFTER EI-24 HRS---WILL NOT BE EXECUTED.
	5-124	RESERVED
	5-125	BACKUP ENTRY IS CONSTRAINED AS FOLLOWS--- A. THE CONSTANT G ENTRY MUST FALL BETWEEN 3 AND 5 G'S. B. EMS RANGING WILL NOT BE ATTEMPTED UNTIL V IS LESS THAN 25500 FPS.
	5-126	WEATHER AVOIDANCE WITH AERODYNAMIC LIFT WILL NOT BE ATTEMPTED UNLESS THE G&N IS OPERATIONAL, OR EMS-INDICATED VELOCITY IS LESS THAN 25500 FPS.

R	ITEM	
	5-127	PREDICTED ENTRY CORRIDOR VIOLATION AFTER THE LAST MCC OPPORTUNITY--- A. UNDERSHOOT LINE EXCEEDED--- GROUND ADVISE CREW TO FLY FULL LIFT UNTIL PEAK G IS PASSED, THEN FLY G&N. B. OVERSHOOT LINE EXCEEDED---GROUND ADVISE CREW TO FLY NEGATIVE LIFT TO 2 G'S FOLLOWED BY 4 G CONSTANT ENTRY.
	5-128	RESERVED
	5-129	RESERVED
	5-130	THE G&N IS NO-GO DURING ENTRY IF--- A. P65 VALUE OF VL DIFFERS FROM THE GROUND COMPUTED LIMITS B. P65 VALUE OF DL DIFFERS FROM THE GROUND COMPUTED LIMITS. C. CAUSES TRAJECTORY TO VIOLATE THE OFFSET LIMITS (SKIP) ON EMS SCROLL. D. CAUSES TRAJECTORY TO VIOLATE THE ONSET LIMITS (G) ON EMS SCROLL. E. IF THE G&N TRIM ATTITUDES AT CM/SM SEP DIFFER FROM THE HORIZON MONITOR ATTITUDE BY GREATER THAN 5 DEG. F. IF THE G&N TRIM ATTITUDES AT .05 G DIFFERS FROM THE GROUND VALUES BY GREATER THAN 5 DEG. G. IF THE CMC FAILS TO SEQUENCE FROM P63 TO P64 AT RET .05 G +/- 5 SEC.

R	ITEM	
	5-131	TEI ABORTS AND RESIDUAL TRIMMING PHILOSOPHY.

A. IN GENERAL ONCE THE SPS HAS BEEN IGNITED, THE MANEUVER WILL BE COMPLETED WITH THE SPS ENGINE. THIS IMPLIES THAT THERE WILL BE NO MANUAL SHUTDOWNS AND AS MANY RESTARTS AS NECESSARY TO COMPLETE THE TEI MANEUVER. QUANTITIES FOR THE DELTA V RULES LISTED BELOW FOR PREMATURE SHUTDOWNS ARE GUIDLINES FOR USE OF RCS PROPELLANT.

1. NO SPS IGNITION- DO NOT ATTEMPT A MANUAL RESTART. SLIP 1 REV AND DO MALFUNCTION PROCEDURES.

2. AFTER SPS IGNITION, THERE WILL BE NO MANUAL SPS SHUTDOWN.

3. FOR PREMATURE SHUTDOWN---

(A) TEI DELTA V REMAINING GREATER THAN THE RCS DELTA V CAPABILITY MINUS 20 FPS - RESTART SPS AND COMPLETE THE TARGETED BURN. NO TRIM.

(B) TEI DELTA V REMAINING LESS THAN THE RCS DELTA V CAPABILITY MINUS 20 FPS, BUT GREATER THAN 5 FPS - RCS +X OR SPS MAY BE USED TO COMPLETE THE TARGETED BURN BASED UPON CREW JUDGEMENT. NO TRIM.

(C) RESIDUAL LESS THAN 5 FPS - TRIM X AND Z.

NOTE--- THIS RULE ALSO APPLIES FOR A DPS TEI WITH NO OPERATIONAL SPS FOR BACKUP.

B. PREMATURE DPS TEI SHUTDOWN WITH AN OPERATIONAL SPS AS BACKUP.

1. NO DPS IGNITION - SLIP 1 REV AND DO MALFUNCTION PROCEDURES AND RETARGET USING DPS OR SPS.

2. FOR A PREMATURE SHUTDOWN IN THE MODE III REGION (ACHIEVED TEI DELTA V LESS THAN 1700 FPS/PRE-ABORT PERIOD LESS THAN 15 HR) - TARGET THE SPS FOR THE NEXT TEI.

3. FOR A PREMATURE SHUTDOWN IN THE MODE I REGION (ACHIEVED TEI DELTA V GREATER THAN 1700 FPS) - TARGET THE SPS AT TEI + 2 HR.

RULES 5-132 THRU 5-139 ARE RESERVED.

R	ITEM	
		RANGE SAFETY RULES AND AGREEMENTS
		GENERAL
	5-140	RANGE SAFETY POLICIES AND CRITERIA ARE SPECIFIED IN AFETR MANUAL (AFETRM) 127-1 DATED 1 JANUARY 1969. THE FOLLOWING MISSION RULES CONCERNING SPECIFIC AFETR/NASA INTERFACE SUPPLEMENT AFETRM 127-1.
	5-141	THE RSO WILL ACCOMPLISH THE PAD EMERGENCY RANGE CUTOFF PROCEDURE IF THE SPACE VEHICLE WILL NOT LIFT OFF AFTER IGNITION AND NASA IS UNABLE TO ACCOMPLISH CUTOFF. THE RSO WILL SEND ''ARM/MFCO'' ONLY IN RESPONSE TO A CODED VERBAL REQUEST FROM THE NASA LAUNCH VEHICLE TEST CONDUCTOR (CLTC). THE CLTC WILL CALL THE RSO ON THE CLTC-RSO DIRECT LINE TO TRANSMIT THIS REQUEST. THE RSO WILL NOT EXECUTE THIS PROCEDURE IF HE HAS A LIFTOFF INDICATION.
	5-142	THE FLIGHT DIRECTOR (FD) WILL INITIATE ABORT IN RESPONSE TO A CODED VERBAL REQUEST FROM THE RSO. THIS PROCEDURE WILL BE EXECUTED IF RANGE SAFETY FLIGHT TERMINATION CRITERIA HAVE BEEN VIOLATED AND RSO EFFORTS TO TERMINATE THRUST HAVE FAILED. THE REQUEST FROM RSO TO FD WILL BE TRANSMITTED ON THE FLIGHT DIRECTOR LOOP WITH THE FIDO-RSO PRIVATE LINE AS BACKUP.
	5-143	THE RSO WILL SEND ''ARM/MFCO'' IN RESPONSE TO A CODED VERBAL REQUEST FROM THE FLIGHT DIRECTOR (FD) OR THE FLIGHT DYNAMICS OFFICER (FIDO). THIS PROCEDURE WILL BE EXECUTED IF ABORT LIMITS HAVE BEEN EXCEEDED AND ABORT ACTION HAS BEEN UNSUCCESSFUL. THE REQUEST FROM FD/FIDO TO THE RSO WILL BE TRANSMITTED ON THE RSO LOOP (CAPE 111), WITH THE FIDO-RSO PRIVATE LINE AS BACKUP.
	5-144	THE FD WILL INFORM THE RSO WHEN THE S-IC NO. 3 OR NO. 4 ENGINE HAS SHUT DOWN BY STATING ''RSO, NO. 3 OUT (NO. 4 OUT)''ON THE RSO LOOP (CAPE 111) AND/OR ACTIVATE THE ENGINE OUT LIGHT ON THE RSO CONSOLE. THE NO. 3 ENGINE OUT LIGHT CIRCUIT FOR FD TO RSO IS HIGHLY DESIRABLE.
	5-145	IF RANGE SAFETY DESTRUCT LINES ARE VIOLATED, THE RSO WILL SEND ''ARM/MFCO'' AND NOTIFY THE FD/FIDO. NO SPS THRUSTING WILL BE INITIATED FOLLOWING SUCH RANGE SAFETY ACTION.
	5-146	IF AN ESTABLISHED IMPACT PREDICTION (IP) POINT IS ON THE CAPE KENNEDY LAND AREA, ''DESTRUCT/PD'' WILL BE TRANSMITTED.

R	ITEM	
	5-147	IF AN ATTEMPT TO TERMINATE THRUST BY ''ARM/MFCO'' IS UNSUCCESSFUL WHILE THE IP IS ON THE CAPE KENNEDY LAND AREA, ''DESTRUCT/PD'' WILL BE SENT.
	5-148	WHEN THE IP HAS MOVED OFF THE CAPE, FLIGHT TERMINATION ACTION WILL BE LIMITED TO ''ARM/MFCO'' OR CREW INITIATED ABORT. THE ''DESTRUCT/PD'' FUNCTION WILL BE SENT ONLY AFTER FD/FIDO CONFIRMATION OF SATISFACTORY SPACECRAFT SEPARATION, AND ONLY IF FUEL DISPERSION IS NECESSARY.
	5-149	IF AN IP POINT IS ESTABLISHED AND ''DESTRUCT/PD'' IS DEEMED UNNECESSARY, THE RSO WILL NOTIFY FD/FIDO, ''SAFE WILL BE SENT UPON FD/FIDO'S REQUEST---''RSO SEND SAFE''.
	5-150	FD/FIDO WILL DECLARE TO THE RSO WHEN THERE IS NO POSSIBILITY OF INSERTING THE SPACECRAFT INTO AN ORBIT, AND THE RSO WILL NOT ALLOW THE AFRICAN GATE TO BE OVERFLOWN.
	5-151	AN ETR RANGE SAFETY OFFICER (BRSO) IS REQUIRED AT BERMUDA TO MONITOR PRESENT POSITION AND IMPACT PREDICTION CHARTS, TO OBSERVE TELEMETRY DISPLAYS, AND TO TRANSMIT THE RANGE SAFETY FUNCTIONS WHEN COMMANDED TO DO SO BY THE RSO. FOR FLIGHT AZIMUTHS LESS THAN 090 DEGREES THE BRSO WILL ASSUME PRIMARY RANGE SAFETY RESPONSIBILITY IN THE EVENT OF LOSS OF COMMUNICATIONS BETWEEN THE BRSO AND THE RSO.
	5-152	SAFING BY THE RSO WILL BE TRANSMITTED AFTER GATE PENETRATION AND FIRST S-IVB CUTOFF WHEN THE FD/FIDO REQUESTS---''RSO SEND SAFE.'' WHEN SAFING IS CONFIRMED, THE RSO WILL STATE ''SAFING CONFIRMED''. IN THE EVENT OF LOSS OF COMM WITH FD/FIDO, THE RSO WILL SEND SAFE ONLY IF HE CAN CONFIRM S-IVB CUTOFF.
	5-153	IF SAFING CANNOT BE CONFIRMED BY THE RSO, ANOTHER SAFING ATTEMPT WILL BE MADE BY THE RSO ON THE FIRST ORBITAL PASS OVER THE CAPE. COORDINATION WILL BE EFFECTED WITH THE SUPERINTENDENT OF RANGE OPERATIONS (SRO) AND FIDO TO ENSURE COMMAND COVERAGE, AND TELEMETRY DISPLAY AVAILABILITY. AT THE AGREED TIME,-FIDO WILL STATE, '' RSO SEND SAFE''. UPON CONFIRMATION, THE RSO WILL STATE, ''SAFING CONFIRMED''.
	5-154	THE FD/FIDO WILL INFORM THE RSO IMMEDIATELY UPON DETERMINATION OF A SPACECRAFT SEPARATION. THIS NOTIFICATION WILL BE TRANSMITTED ON THE RSO LOOP (CAPE 111) WITH THE FIDO-RSO PRIVATE LINE AS BACKUP.

R	ITEM	
		' TRACKING SOURCES '
	5-155	AT LEAST TWO (2) VEHICLE POSITION DATA SOURCES ARE MANDATORY TO L/O FOR EACH PHASE OF POWERED FLIGHT PRIOR TO THE AFRICAN GATE TO ENABLE THE RANGE SAFETY OFFICER TO DETERMINE IF THE VEHICLE IS NORMAL OR VIOLATES ESTABLISHED INFLIGHT SAFETY CRITERIA.
	5-156	DATA FROM TWO (2) OF THE FOLLOWING THREE (3) RADARS ARE MANDATORY TO L/O (OTHER HIGHLY DESIRABLE)--- BERMUDA FPS-16, BERMUDA FPQ-6, AND GRAND TURK TPQ-18.
	5-157	PRESENT POSITION AND IP PLOTS AT BERMUDA (BDA) USING INPUTS FROM EITHER THE BDA FPS-16 OR BDA FPQ-6 RADAR ARE HIGHLY DESIRABLE FOR LAUNCH.

R	ITEM	
		' AIRBORNE SYSTEMS '
	5-158	TWO (2) OPERATIONAL RANGE SAFETY COMMAND RECEIVERS ON EACH LAUNCH VEHICLE STAGE (S-IC, S-II, AND S-IVB) ARE MANDATORY TO L/O. THE RANGE SAFETY SUPERVISOR (CRSS) AT THE LAUNCH CONTROL CENTER WILL DETERMINE IF THE RECEIVERS ARE OPERATING PROPERLY.
	5-159	IU C-BAND BEACON NO. 1 OR NO. 2 IS HIGHLY DESIRABLE FOR LAUNCH.

R	ITEM	
		'' COMMAND/CONTROL '
	5-160	NASA BERMUDA DRS COMMAND/CONTROL CAPABILITY IS MANDATORY TO L/O FOR FLIGHT AZIMUTHS LESS THAN 90 DEGREES.
	5-161	A 4 SECOND TIME DELAY BETWEEN ''ARM/MFCO'' AND ''DESTRUCT/PD'' WILL BE PROVIDED BY TIMERS IN THE RSO CONSOLE IN THE RCC.

R	ITEM	
		COMMUNICATIONS
	5-162	ONE (1) OF TWO (2) PRIVATE, INDEPENDENT, GEOGRAPHICALLY DIVERSIFIED COMMUNICATIONS LINKS BETWEEN THE RSO AND BRSO IS MANDATORY AND THE OTHER IS HIGHLY DESIRABLE.
	5-163	ONE (1) OF THE FOLLOWING THREE (3) COMMUNICATIONS LINKS IS MANDATORY BETWEEN THE RSO AND FD/FIDO AND THE OTHERS ARE HIGHLY DESIRABLE. (1) RSO LOOP (CAPE 111). (2) RSO PRIVATE LINE. (3) FLIGHT DIRECTOR LOOP.
	5-164	A COMMUNICATIONS LINK BETWEEN THE RSO AND THE RANGE SAFETY SUPERVISOR (CRSS) AT THE LAUNCH CONTROL CENTER IS MANDATORY FOR T-40 MINUTE DESTRUCT CHECKS.
	5-165	A DIRECT LINE COMMUNICATIONS LINK BETWEEN THE RSO AND THE LAUNCH VEHICLE TEST CONDUCTOR (CLTC) IS HIGHLY DESIRABLE.

R	ITEM	
		' TELEMETRY '
	5-166	IU TELEMETRY DATA (ONBOARD GUIDANCE PARAMETERS) TO THE RTCS ARE HIGHLY DESIRABLE UNTIL S-IVB CUTOFF FOR IP COMPUTATION AND RSO DISPLAY.
	5-167	TELEMETRY REQUIREMENTS TO BE DISPLAYED FOR THE RSO AND THE BRSO ARE HIGHLY DESIRABLE.

R	ITEM	
		RANGE SAFETY WEATHER RESTRICTIONS
	5-168	WIND RESTRICTIONS---
		AN ANNUAL PROFILE WIND RESTRICTION OF SIGMA WILL BE IN EFFECT FOR LAUNCH.
	5-169	CEILING AND VISIBILITY RESTRICTIONS---
		NO CEILING OR VISIBILITY RESTRICTIONS WILL BE IMPOSED PROVIDING CNV FPS-16 AND MILA TPQ-18 RADARS AND BEACON NO. 1 ARE OPERATIONAL.

6 SLV – TB1 THROUGH
TB4/TB4A (LAUNCH)

R	ITEM	

SUMMARY OF LAUNCH PHASE RULES

6-1 S-IC LOSS OF THRUST

6-2 LOSS OF ATTITUDE CONTROL

6-3 INERTIAL PLATFORM FAILURE - ACCELEROMETER

6-4 SLV INERTIAL PLATFORM FAILURE

6-6 EXCESSIVE ATTITUDE ERROR IN PITCH OR YAW DURING S-II BURN

6-7 S-II LOSS OF THRUST

6-8 S-II GIMBAL SYSTEM FAILURE

6-9 S-II SECOND PLANE SEPARATION FAILS

6-10 S-IVB LOSS OF HYDRAULIC FLUID

6-11 S-IVB LOSS OF THRUST

6-12 S-IVB COLD HELIUM SHUTOFF VALVE(S) FAIL OPEN

THE FOLLOWING MISSION RULES ALSO APPLY TO THIS SECTION---

NONE

R	ITEM

A. BSE GENERALIZED SWITCH SELECTOR COMMAND CAPABILITY EXISTS---

1. WHEN CREW ENABLES IU COMMAND SYSTEM (EXCEPT AS NOTED BELOW IN ITEM D)

2. FIVE SECONDS AFTER SPACECRAFT SEPARATION

B. BSE MANEUVER UPDATE AND INHIBIT CAPABILITY EXISTS FOR TB7 MANEUVERS ONLY.

C. BSE HAS NAVIGATION UPDATE CAPABILITY (FMR 6-3) AND TARGET UPDATE CAPABILITY (NO REQUIREMENT)

D. BSE HAS NO COMMAND CAPABILITY DURING POWERED BURN PHASES.

E. A SAFE DISTANCE BETWEEN THE SPACECRAFT AND S-IVB/IU IS DEFINED AS 7000 FT.

F. BSE WILL RECOMMEND NO S-IVB RESTART FOR ANY CONFIRMED CONDITION/ MALFUNCTION IN THE LAUNCH VEHICLE WHICH RESULTS IN---

1. A CATASTROPHIC HAZARD

2. ACHIEVEMENT OF AN S-IVB ENGINE MAINSTAGE BURN WITH EXPECTED CUTOFF OR SHUTDOWN CONDITIONS DEFINITELY PRECLUDING AN ACCEPTABLE LUNAR MISSION. IN APPLYING THIS CRITERIA TO SPECIFIC MISSION RULES, A GO/NO GO RECOMMENDATION WILL BE REQUIRED IF INSUFFICIENT S-IVB CONSUMABLES OR PROPULSION PERFORMANCE IS AVAILABLE TO ASSURE ANY FINITE PROBABILITY OF ACHIEVING A CUTOFF ORBIT WITH 65,000 N.M. APOGEE ALTITUDE.

G. IN THE EVENT OF NO S-IVB IGNITION AT RESTART OR AN EARLY S-IVB SECOND BURN CUTOFF, THE SPACECRAFT SHOULD REMAIN ATTACHED TO THE S-IVB/IU AND MONITOR LH2 AND LOX ULLAGE PRESSURES UNTIL THE STAGE STATUS CAN BE ASSESSED BY GROUND. IF EMERGENCY SEPARATION IS REQUIRED IMMEDIATELY AFTER S-IVB CUTOFF, THE SPACECRAFT SHOULD IMMEDIATELY GO TO A SAFE DISTANCE (7000 FT) FROM THE S-IVB/IU.

H. ABORT OR SPACECRAFT SEPARATION DURING LAUNCH PHASE WILL BE RECOMMENDED FOR THE FOLLOWING---

6-1 S-IC LOSS OF THRUST

6-2 LOSS OF ATTITUDE CONTROL

**6-7 S-II LOSS OF THRUST

**6-8 S-II ANY SINGLE ACTUATOR HARDOVER INBOARD

6-9 S-II SECOND PLANE SEPARATION FAILS TO OCCUR AT TB3 + 31 SEC

6-10 S-IVB LOSS OF ENGINE HYDRAULIC FLUID PRIOR TO FIRST S-IVB BURN

6-11 S-IVB STAGE LOSS OF THRUST

6-12 S-IVB COLD HELIUM SHUTOFF VALVE(S) FAILS OPEN

I. SPACECRAFT GUIDANCE TAKEOVER WILL BE RECOMMENDED FOR THE FOLLOWING---

6-4 LAUNCH VEHICLE INERTIAL PLATFORM FAILURE-ATTITUDE REFERENCE

7-8 LOSS OF ATTITUDE CONTROL DURING TB5, TB7

J. S-II/S-IVB EARLY STAGING WILL BE RECOMMENDED FOR THE FOLLOWING---

**6-6 EXCESSIVE ATTITUDE ERROR IN PITCH OR YAW DURING S-II BURN

**6-7 S-II LOSS OF THRUST

**6-8 S-II ANY SINGLE ACTUATOR HARDOVER INBOARD

**6-12 S-IVB COLD HELIUM SHUTOFF VALVE(S) FAILS OPEN

** TIME DEPENDENT

R	ITEM	

K. TLI INHIBIT PRIOR TO RESTART OR SPACECRAFT SEPARATION WILL BE RECOMMENDED FOR THE FOLLOWING---

7-1 INSUFFICIENT PROPELLANTS REMAIN FOR ACHIEVEMENT OF ACCEPTABLE ALTERNATE MISSIONS.

7-5 FAILURE OF RANGE SAFETY SYSTEM AFTER INSERTION

7-8 LOSS OF ATTITUDE CONTROL

7-22 S-IVB LOSS OF ENGINE HYDRAULIC FLUID

8-6 S-IVB ACTUATOR CONFIRMED HARDOVER PRIOR TO TB6 + 9 MIN 10 SEC

8-8 LOSS OF ATTITUDE CONTROL DURING S-IVB SECOND BURN

L. SPACECRAFT SEPARATION OR TLI INHIBIT WILL BE RECOMMENDED UNLESS COMMAND ACTION IS SUCCESSFUL FOR THE FOLLOWING---

7-4 J-2 ENGINE MAIN OXIDIZER VALVE FAILS TO CLOSE AT FIRST SIVB CUTOFF

*7-6 S-IVB COLD HELIUM SHUTOFF VALVES FAIL TO CLOSE

*7-14 S-IVB STAGE COMMON BULKHEAD DELTA PRESSURE REACHES OR EXCEEDS +36 OR -26 PSID

7-20 J-2 ENGINE START BOTTLE PRESSURE OUTSIDE RESTART LIMITS

* EMERGENCY SEPARATION REQUIRED

M. BSE WILL INHIBIT TB6 IN THE EVENT A TLI NO-GO DECISION IS MADE IN TB5.

N. THERE MUST BE AT LEAST AN 80 MIN COAST PERIOD BETWEEN SIVB FIRST AND SECOND BURNS.

MISSION RULES

SECTION 6 - SLV - TB1 THROUGH TB4/TB4A

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	6-1	S-IC STAGE LOSS OF THRUST	LAUNCH	A. CONTINUE MISSION	A&B. CUES---
					1. THRUST OK SWITCHES - OFF (K33-115 THROUGH K47-115)
		A. ANY SINGLE ENGINE PRIOR TO TB3		BSE INFORM FLIGHT AND FIDO.	
		B. ANY TWO OR MORE ENGINES		B. ABORT/CONTINUE MISSION	2. THRUST CHAMBER PRESSURE LESS THAN 500 PSIA (D8-101 THROUGH D8-105).
		1. PRIOR TO DEACTIVATION OF TWO ENGINES AUTO ABORT		1. ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST.	3. LONGITUDINAL ACCELERATION - (A2-603).
		2. AFTER DEACTIVATION OF TWO ENGINES AUTO ABORT		2. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO. CAPCOM ADVISE CREW OF POTENTIAL OVERRATE CONDITION.	4. FINAL THRUST OK CUTOFF - ON (K52-115 THROUGH K56-115).
					A&B. NOTE---
					CREW MAY DEACTIVATE AUTOMATIC ABORT AFTER TB1 + 120 SEC.
		C. LOSS OF THRUST - ENGINE 3 OR 4 (THIS RULE APPLIES ONLY FOR THE UNIQUE CASE OF ENGINE 3 OR 4 THRUST LOSS BETWEEN 0 TO 45 SEC)	LAUNCH	C. CONTINUE MISSION	C. CUES---
				BSE INFORM FLIGHT AND FIDO. FLIGHT INFORM RSO.	1. THRUST CHAMBER PRESSURE LESS THAN 500 PSIA (D8-103, D8-104).
					2. ENGINE 3 OR ENGINE 4 THRUST OK SWITCHES OFF (K39-115, THROUGH K44-115).
		1. VOICE COMM WITH RSO		1.(A) FLIGHT CONFIRM ENGINE 3 OR 4 OUT VIA RSO PRIVATE LINE.	3. ENGINE 3 OR 4 FINAL THRUST OK CUTOFF (K54-115, K55-115).
					C. NOTES---
				(B) FLIGHT CONFIRM NO OTHER KNOWN ANOMALIES BY LIGHT ACTIVATION AND VOICE REPORT.	1. RSO LOOP 111 OR FD LOOP BACKUP TO PL.
					2. CONFIRMATION OF NO OTHER KNOWN ANOMALIES WILL BE BASED ON ENGINE CHAMBER PRESSURE NOT DECREASING AND TOK SWITCHES ON.
		2. NO VOICE COMM WITH RSO		2. FLIGHT CONFIRM ENGINE 3 OR 4 OUT AND NO OTHER KNOWN ANOMALIES BY LIGHT ACTIVATION.	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	6-2	LOSS OF ATTITUDE CONTROL	LAUNCH		CUES---
		A. PRIOR TO TB1 + 2 MIN		A. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO CREW WILL ABORT ON LIMITS (NOTE A.1)	A.1. ANGULAR RATES-PITCH (R4-602)OR YAW (R5-602) GREATER THAN 2 DEG/SEC AND NOT DECREASING. ROLL (R6-602) GREATER THAN 5 DEG/SEC AND NOT DECREASING. 2. ANGULAR RATES-PITCH (R13-602) OR YAW (R8-602) GREATER THAN 2 DEG/SEC AND NOT DECREASING. ROLL (R12-602) GREATER THAN 5 DEG/SEC AND NOT DECREASING (SEE NOTE A.2) 3. LOSS OF ATTITUDE CONTROL ALERT (SEE NOTE A.3.) NOTES--- A.1. CREW ABORT LIMITS--- (A) PITCH AND YAW RATE +/- 4 DEG/SEC (B) ROLL RATE +/- 20 DEG/SEC (C) PITCH, YAW, OR ROLL ERROR +/- 5 DEG AND Q-BALL DELTA P +/- 3.2 PSID 2. THESE CUES ARE VALID IF RATE CHANNEL SWITCHOVER HAS NOT OCCURRED. 3. LOSS OF ATTITUDE CONTROL ALERT WILL BE GIVEN FOR THE FOLLOWING CONDITIONS--- (A) LVDC/LVDA COMPUTATIONAL FAILURE (B) ATTITUDE ERROR SIGNALS GREATER THAN +/- 5 DEG. (C) FAILURE TO INITIATE PROPER GUIDANCE SEQUENCE (D) S-IC ENGINE ACTUATOR HARDOVER GREATER THAN +/- 5 DEG.
		B. BETWEEN TB1 + 2 MIN AND TB5 INITIATE	LAUNCH	B. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO CREW WILL ABORT ON LIMITS (NOTE B.1.)	CUES--- B.1. ANGULAR RATES - PITCH (R4-602), YAW (R5-602), OR ROLL (R6-602) GREATER THAN 5 DEG/SEC AND NOT DECREASING. 2. ANGULAR RATES - PITCH (R13-602), YAW (R8-602), OR ROLL (R12-602) GREATER THAN 5 DEG/SEC AND NOT DECREASING. (SEE NOTE B.2) 3. LOSS OF ATTITUDE CONTROL ALERT. (SEE NOTE B.3) NOTES--- B.1 CREW ABORT LIMITS--- (A) PITCH OR YAW RATE +/- 10 DEG/SEC (B) ROLL RATE +/- 20 DEG/SEC 2. THESE CUES ARE VALID IF RATE CHANNEL SWITCH OVER HAS NOT OCCURRED.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	6-2 CONT				3. LOSS OF ATTITUDE CONTROL ALERT WILL BE GIVEN FOR THE FOLLOWING CONDITIONS--- (A) LVDC/LVDA COMPUTATIONAL FAILURE. (B) ATTITUDE ERROR SIGNALS PITCH, YAW, OR ROLL GREATER THAN + 5 DEG (TB1 + 120 SEC AND S-II BURN)-- ROLL GREATER THAN +/- 3.5 DEG, PITCH AND YAW GREATER THAN +/- 5 DEG (S-IVB BURN ONLY) (C) FAILURE TO INITIATE PROPER GUIDANCE SEQUENCE (D) S-IVB ENGINE ACTUATOR HARDOVER GREATER THAN +/- 5 DEG (S-II BURN ONLY) (E) FAILURE OF S-IVB ENGINE HYDRAULICS (S-IVB BURN ONLY)
	6-3	INERTIAL PLATFORM FAILURE - ACCELEROMETER (ONE OR MORE AXIS)	LAUNCH COAST RESTART	CONTINUE MISSION BSE INFORM FLIGHT FIDO, AND GUIDO CAPCOM ADVISE CREW	CUES--- 1. GUIDANCE STATUS WORD (MODE CODE 24 (H60-603) BITS D26 AND D25 FOR Z ACCEL SET TO 'ONE' BITS D24 AND D23 FOR X ACCEL SET TO 'ONE' BITS D22 AND D21 FOR Y ACCEL SET TO 'ONE' 2. ACCELEROMETER PICKOFFS (X, Y, OR Z) INDICATE IN EXCESS OF 3 DEG AND NOT DECREASING. (H10-603, H11-603, H12-603) NOTES--- 1. NO EFFECT ON VEHICLE TRAJECTORY DURING S-IC STAGE BURN. 2. LVDC SWITCHES TO A BACKUP MODE AND UTILIZES A PRECOMPUTED F/M PROFILE FOR FAILED AXIS DURING THE S-IC, S-II, AND S-IVB BURNS. THE IU STATE VECTOR THEREAFTER MAY NOT REFLECT THE ACTUAL FLIGHT TRAJECTORY. 3. IU STATE VECTOR AT INSERTION MAY BE NO GO AND A NAV UPDATE MAY BE REQUIRED FOR ACCEPTABLE INITIATION OF TB6 AND ACCEPTABLE TLI GUIDANCE. 4. CREW WILL INITIATE MANUAL CUTOFF FOR AN OVERSPEED CONDITION. 5. THE SECOND BURN PRECOMPUTED F/M PROFILE FOR THE FAILED AXIS ASSUMES NOMINAL PROPULSION PERFORMANCE AND NOMINAL MASS HISTORY.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	6-4	LAUNCH VEHICLE INERTIAL PLATFORM FAILURE - ATTITUDE REFERENCE	ALL	CONTINUE MISSION BSE INFORM FLIGHT AND RECOMMEND SPACECRAFT GUIDANCE TAKEOVER	CUES--- 1. GUIDANCE REFERENCE FAILURE (D04 OR D06 MODE CODE 26 BIT D8 SET TO ''ONE'' (H60-603) 2. GUIDANCE STATUS WORD-(MODE CODE 24) (H60-603) BITS D20 AND D19 FOR Z GIMBAL SET TO ''ONE'' BITS D18 AND D17 FOR X GIMBAL SET TO ''ONE'' BITS D16 AND D15 FOR Y GIMBAL SET TO ''ONE'' 3. LADDER OUTPUTS CONSTANT FOR FAILED AXES (H54-603, H55-603, H56-603) 4. ATTITUDE ERROR CONSTANT FOR FAILED AXES(H69-602, H70-602, H71-602) NOTES--- 1. IN THE EVENT OF THIS FAILURE PRIOR TO TB6, THE CREW WILL HAVE TO INITIATE TB6.
	6-5	RESERVED			
	6-6	EXCESSIVE ATTITUDE ERROR IN PITCH OR YAW DURING S-II BURN A. PRIOR TO S-IVB TO COI CAPABILITY B. AFTER S-IVB TO COI CAPABILITY C. AFTER S-II CUTOFF MINUS 30 SECONDS	LAUNCH	CONTINUE MISSION/EARLY STAGE A. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO B. EARLY STAGE BSE INFORM FLIGHT AND FIDO AND RECOMMEND EARLY STAGING C. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO	CUES--- 1. COMMANDED ANGLES MINUS GIMBAL ANGLES (H60-603) GREATER THAN 20 DEG AND DIVERGING 2. ACTUATORS NOT RESPONDING (G8-201 THRU 204, G9-201 THRU 204, G30-201 THRU 204, G31-201 THRU 204) 3. VERIFIED TRAJECTORY DEVIATION. NOTES--- THIS RULE DOES NOT APPLY FOR OTHER IDENTIFIED LAUNCH VEHICLE MALFUNCTIONS. SEE FMR 6-2, 6-3, 6-4, 6-7, AND 6-9.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	6-7	S-II LOSS OF THRUST	LAUNCH		A. CUES---
		A. ANY SINGLE ENGINE FAILURE TO ATTAIN THRUST OR LOSS OF THRUST PRIOR TO NOMINAL S-II CUTOFF		A. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO.	1. THRUST OK SWITCHES-OFF (K285-201 THROUGH 205, K286-201 THROUGH 205).
					2. THRUST CHAMBER PRESSURE- ZERO (D13-201 THROUGH 205).
					3. LONGITUDINAL ACCELERATION (A2-603).
		B. ANY TWO ENGINES- FAILURE TO ATTAIN THRUST OR LOSS OF THRUST---		B. CONTINUE MISSION/EARLY STAGE	B. CUES---
					1. THRUST OK SWITCHES OFF (K285-201 THROUGH 205-- K286-201 THRU 205)
		1. ADJACENT CONTROL ENGINES		1. CONTINUE MISSION	2. THRUST CHAMBER PRESSURE ZERO (D13-201 THROUGH 205)
					3. LONGITUDINAL ACCELERATION (A2-603)
		(A) PRIOR TO S-IVB TO COI		(A) BSE INFORM FLIGHT AND FIDO CREW WILL ABORT ON LIMITS (NOTE B.1)	
		(B) AFTER S-IVB TO COI BUT LESS THAN TB3+4 MIN 40 SEC		(B) EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGE	NOTES---
					B.1. CREW ABORT LIMITS
					(A) PITCH OR YAW RATE +/- 10 DEG/SEC
		(C) AFTER TB3+4 MIN 40 SEC		(C) CONTINUE MISSION	(B) ROLL RATE +/- 20 DEG/SEC
					B.2. TB3 TIME BASED ON A 3 SIGMA CONSUMABLE TLI CAPABILITY TO 65,000 NM
		2. NON ADJACENT CONTROL ENGINES		2. CONTINUE MISSION	
		C. THREE OR MORE ENGINES OUT		C. ABORT/EARLY STAGE/ CONTINUE MISSION	C. CUES---
					C.1. THRUST OK SWITCHES OFF (K285-201 THRU 205-- K286-201 THRU 205)
		1. PRIOR TO S-IVB TO COI CAPABILITY		1. ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST.	2. THRUST CHAMBER PRESSURE ZERO (D13-201 THRU 205)
		2. AFTER S-IVB TO COI CAPABILITY BUT PRIOR TO LOW LEVEL SENSE ARM		2. EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING.	3. LONGITUDINAL ACCELERATION (A2-603)
					C. NOTE---
				3. EARLY STAGE/ CONTINUE MISSION	AFTER PROGRAMMED S-II CENTER ENGINE CUTOFF, ENGINES OUT REFERS ONLY TO CONTROL ENGINES.
		3. AFTER LOW LEVEL SENSE ARM			
		(A) 3 CONTROL ENGINES OUT		(A) EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGE.	
		(B) ALL ENGINES OUT		(B) CONTINUE MISSION BSE INFORM FLIGHT	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	6-8	S-II STAGE ANY SINGLE ACTUATOR HARDOVER INBOARD	LAUNCH	ABORT/EARLY STAGE/CONTINUE MISSION	
		A. PRIOR TO S-IVB TO COI CAPABILITY		A. ABORT- BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST	CUES--- 1. YAW ACTUATOR POSITION EXCEEDS +6 DEG (G8-201 THRU 204, G30-201 THRU 204)
		B. BETWEEN S-IVB TO COI CAPABILITY AND 30 SEC PRIOR TO S-II CUTOFF		B. EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING	2. PITCH ACTUATOR POSITION EXCEEDS +6 DEG (G9-201 THRU 204, G31-201 THRU 204) 3. ADJACENT CONTROL ENGINE ACTUATOR IN SAME PLANE MOVES 4 1/2 DEG INBOARD (SAME MEASUREMENTS AS CUES 1 AND 2)
		C. AFTER S-II CUTOFF MINUS 30 SEC		C. CONTINUE MISSION- BSE INFORM FLIGHT	NOTES--- 1. THE CREW SHOULD ABORT OR EARLY STAGE AS SOON AS POSSIBLE AFTER MALFUNCTION OCCURS TO PRECLUDE EXCESSIBE THERMAL PROBLEM IN AFT INTERSTAGE.
	6-9	S-II SECOND PLANE SEPARATION FAILS TO OCCUR AT TB3 + 31 SEC	LAUNCH	ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST. CREW ABORT PRIOR TO TB3 + 66 SEC.	CUES--- 1. SECOND PLANE SEPARATION INDICATION SHOWS NO SEPARATION (M86-206, M87-206) 2. GUIDANCE MODE WORD 1 MODE CODE 25 BIT D15 REMAINS ZERO (H60-603). 3. IGNITION BUS VOLTAGE REMAINS AT APPROXIMATELY 28 VOLTS (M125-207). 4. RECIRCULATION BUS VOLTAGE REMAINS AT APPROXIMATELY 56 VOLTS (M111-207) NOTES--- THE CREW SHOULD ABORT AS SOON AS POSSIBLE AFTER MALFUNCTION OCCURS TO PRECLUDE EXCESSIVE THERMAL PROBLEMS IN AFT INTERSTAGE.

MISSION RULES

SECTION 6 - SLV - TB1 THROUGH TB4/TB4A

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	6-10	S-IVB LOSS OF HYDRAULIC FLUID PRIOR TO FIRST S-IVB BURN	LAUNCH	NO SIVB START BSE INFORM FLIGHT AND FIDO AND RECOMMEND NO S-IVB START. CAPCOM ADVISE CREW	CUES--- 1. HYDRAULIC RESERVOIR OIL LEVEL APPROX ZERO PERCENT (L7-403). 2. HYDRAULIC SYSTEM PRESSURE LESS THAN 1700 PSIA (D41-403). 3. HYDRAULIC RESERVOIR PRESSURE APPROX ZERO PSIA (D42-403). NOTES--- 1. L7-403 PLUS ONE OF THE OTHER CUES ARE REQUIRED FOR IMPLEMENTATION OF THIS RULE. 2. IF ALL THREE CUES ARE FUNCTIONING PROPERLY, THEY ARE REQUIRED FOR IMPLEMENTATION OF THIS RULE. 3. SPACECRAFT SHOULD HAVE COI CAPABILITY AT S-II CUTOFF 4. AT SII CUTOFF, THE CREW SHOULD INHIBIT THE SIVB START WITH THE TRANSLATION HANDCONTROLLER.
	6-11	S-IVB STAGE LOSS OF THRUST A. FAILS TO ATTAIN THRUST OR PREMATURE SHUTDOWN PRIOR TO OBTAINING PARKING ORBIT B. SHUTDOWN PRIOR TO A 65,000 N. M. APOGEE ALTITUDE, AND ENTRY INTO TB7 FOR REASONS OTHER THAN A PROPELLANT DEPLETION	LAUNCH TLI	A. SPACECRAFT SEPARATION BSE INFORM FLIGHT AND FIDO B. CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND--- 1. LH2 REPRESS CONTROL VALVES CLOSED 2. LH2 LATCHING RELIEF VALVE UNLATCHED AND CLOSED 3. LOX NPV OPEN OFF 4. LH2 CONTINUOUS VENT SYSTEM OPEN 5. SPACECRAFT SEPARATION ATTITUDE MANEUVER INHIBIT 6. OPEN PREVALVES AND RECIRC VALVES THE SPACECRAFT SHOULD REMAIN ATTACHED TO THE S-IVB/IU AND MONITOR LH2 AND LOX TANK ULLAGE PRESSURES. IF SEPARATION IS REQUIRED, THE SPACECRAFT SHOULD IMMEDIATELY GO TO A SAFE DISTANCE (7000F FT) FROM THE S-IVB/IU.	CUES--- 1. THRUST CHAMBER PRESSURE - ZERO (D1-401). 2. THRUST OK SWITCHES - OFF (K14-401, K157-401). 3. LONGITUDINAL ACCELERATION - ZERO (A2-603). 4. TB5 IS INITIATED. MODE CODE 25, BIT D2 SET TO ONE (H60-603). 5. TB7 IS INITIATED. MODE CODE 26, BIT D20 SET TO ONE (H60-603) NOTE--- SEPARATION WILL BE REQUIRED FOR VIOLATION OF FMR 7-6 OR FMR 7-14.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	6-12	S-IVB COLD HELIUM SHUTOFF VALVES FAIL OPEN	LAUNCH		CUES---
		A. PRIOR TO LAUNCH ESCAPE TOWER JETTISON AND LOX TANK ULLAGE PRESSURE IS 50 PSIA OR SATURATED AT UPPER LEVEL		A. ABORT BSE INFORM FLIGHT AND TRANSMIT ABORT REQUEST	A. 1. LOX TANK ULLAGE PRESSURE (D179-406) 2. LOX TANK ULLAGE PRESSURE (D180-406)
		B. BETWEEN LAUNCH ESCAPE TOWER JETTISON AND 50 SEC PRIOR TO SII CUTOFF		B. EARLY STAGE BSE INFORM FLIGHT AND RECOMMEND EARLY STAGING IMMEDIATELY	B&C 1. COLD HELIUM REG DISCHARGE PRESSURE REMAINS GREATER THAN 200 PSIA FOR A MINIMUM OF 20 SECONDS (D105-403) 2. LOX ULLAGE PRESSURE AT RELIEF SETTING (41-44 PSIA) AND RELIEVING (D179-406, D180-406) 3. COLD HE BOTTLE PRESSURE DECAYING (D261-403, D263-403)
		C. AFTER S-II CUTOFF MINUS 50 SEC		C. CONTINUE MISSION BSE INFORM FLIGHT	NOTE--- ALL CUES MUST INDICATE THE FAILURE FOR IMPLEMENTATION OF THIS RULE.

7 SLV – TB5 AND TB7(COAST)

R	ITEM	

SUMMARY OF COAST PHASE RULES

7-1 INSUFFICIENT PROPELLANT

7-2 LOSS OF ONE APS MODULE

7-3 MAIN FUEL VALVE FAILS TO CLOSE

7-4 MAIN OXIDIZER VALVE FAILS TO CLOSE

7-5 RANGE SAFETY SYSTEM NOT SAFED AFTER INSERTION

7-6 COLD HELIUM SHUTOFF VALVE FAILS OPEN

7-7 AUXILIARY HYDRAULIC PUMP FAILS

7-8 LOSS OF ATTITUDE CONTROL

7-9 CONTINUOUS VENT REGULATOR FAILS TO OPEN

7-10 APS ULLAGE ENGINE FAILS ON

7-11 RESERVED

7-12 RESERVED

7-13 IU ENVIRONMENTAL CONTROL SYSTEM FAILS

7-14 COMMON BULKHEAD DELTA P

7-15 LOSS OF S-IVB STAGE PNEUMATICS

7-16 RESERVED

7-17 LH2 TANK VENT FAILURE OR LEAK

7-18 LOW COLD HELIUM SUPPLY

7-19 LOX TANK ULLAGE PRESSURE IS LESS THAN 31 PSIA

7-20 J-2 ENGINE START BOTTLE PRESSURE OUTSIDE RESTART LIMITS

7-21 PU VALVE FAILURE

7-22 S-IVB LOSS OF HYDRAULIC FLUID

7-23 RESERVED

7-24 RESERVED

7-25 LOX NON-PROPULSIVE VENT FAILS TO OPEN

7-26 LH2 LATCHING VENT VALVE FAILS TO OPEN

7-27 GH2 START BOTTLE DUMP FAILS TO OCCUR

7-28 COLD HELIUM DUMP FAILS TO OCCUR

7-29 RESERVED

7-30 RESERVED

THE FOLLOWING MISSION RULES ALSO APPLY TO THIS SECTION---

6-3 INERTIAL PLATFORM FAILURE - ACCELEROMETER

6-4 LAUNCH VEHICLE INERTIAL PLATFORM FAILURE-ATTITUDE REFERENCE

MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-1	PRIOR TO RESTART, INSUFFICIENT PROPELLANT REMAINS FOR ACHIEVEMENT OF ACCEPTABLE ALTERNATE MISSION.	EARTH ORBIT	NO S-IVB RESTART BSE INFORM FLIGHT AND RECOMMEND NO S-IVB RESTART.	CUE--- PROPELLANT REMAINING AS ASCERTAINED DURING REAL-TIME EVALUATIONS
	7-2	LOSS OF ONE APS MODULE			
		A. TB5 TO TB6+9 MIN 20 SEC	EARTH ORBIT TLC	A. CONTINUE MISSION 1. BSE INFORM FLIGHT AND COMMAND- S-IVB BURN MODE ON 2. CREW WILL STABILIZE THE VEHICLE WITH CSM RCS	CUES--- 1. MANIFOLD PRESSURE MOD. 1 BELOW 100 PSIA (D70-414), (D71-414) 2. MANIFOLD PRESSURE MOD. 2 BELOW 100 PSIA (D72-415), (D73-415)
		B. TB7 TO TB7+15 MIN		B. CONTINUE MISSION 1. BSE INFORM FLIGHT AND COMMAND - FCC POWER OFF 2. CREW WILL STABLIZE VEHICLE WITH CSM RCS	
		C. TB7+15 MIN TO LM EJECTION		C. CONTINUE MISSION 1. BSE INFORM FLIGHT AND COMMAND - FCC POWER OFF 2. CREW DISCRETION FOR DOCKING	
		D. LM EJECTION TO YAW MANEUVER COMPLETE		D. CONTINUE MISSION 1. BSE INFORM FLIGHT AND COMMAND - FCC POWER OFF 2. SPACECRAFT WILL DO EVASIVE MANEUVER 3. DO NOT INITIATE TB8 4. BSE PERFORM NON-PROPULSIVE S-IVB SAFING BY GROUND COMMAND	
		E. AFTER YAW ATTITUDE MANEUVER COMPLETE		E. CONTINUE MISSION BSE INFORM FLIGHT AND 1. AFTER ULLAGE BURN, COMMAND - S-IVB BURN MODE ON 2. AFTER LOX DUMP AND PRIOR TO APS BURN, COMMAND - S-IVB BURN MODE OFF 3. AFTER COMPLETION OF LUNAR IMPACT BURNS, COMMAND FCC POWER OFF	NOTES--- LIMITS IN FMR 7-8 CONDITION/MALFUNCTION "D" DO NOT APPLY TO THE FAILURE IN 7-2 CONDITION/MALFUNCTION E.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-3	J-2 ENGINE MAIN FUEL VALVE (MFV) FAILS TO CLOSE AT---			CUES---
		A. FIRST S-IVB CUTOFF	EARTH ORBIT	A. CONTINUE MISSION	1. MAIN FUEL VALVE POSITION (G4-401).
				BSE INFORM FLIGHT AND COMMAND (ASAP)---	2. MAIN FUEL VALVE OPEN (K118-401).
				1. PREVALVES AND RECIRC SHUTOFF VALVES CLOSED (SEE NOTE1)	3. FUEL FLOWMETER FLOWRATE (F2-401).
				2. ATTEMPT TO CYCLE AND CLOSE MFV	4. FUEL RECIRC FLOWRATE (F5-404).
				IF SUCCESSFUL, BSE COMMAND---	NOTES---
				3. PREVALVE AND RECIRC SHUTOFF VALVES OPEN	1. IF THE MFV IS OPEN, THE LH2 PUMP INLET PRESSURE WILL GO TO ZERO AFTER COMMAND ACTION (A.1).
					2. THIS FAILURE WILL REQUIRE EVALUATION OF LH2 RESIDUALS TO DETERMINE ADEQUACY FOR TLI VELOCITY CUTOFF (REF FMR 7-1).
					3. A FAILURE FOLLOWING SECOND BURN CUTOFF WILL REQUIRE A RE-EVALUATION OF LUNAR IMPACT VELOCITY DESIRED.
		B. SECOND S-IVB CUTOFF	TLC	B. CONTINUE MISSION	
				BSE INFORM FLIGHT AND	
				1. ATTEMPT TO CLOSE MFV WHEN LOX DUMP IS COMPLETE, BSE CMD.	
				2. PREVALVES AND RECIRC VALVES CLOSE	

RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
7-4	J-2 ENGINE MAIN OXIDIZER VALVE (MOV) FAILS TO CLOSE AT---			CUES---
	A. FIRST S-IVB CUTOFF	EARTH ORBIT	A. CONTINUE MISSION/ NO S-IVB RESTART BSE INFORM FLIGHT AND COMMAND (ASAP)--- 1. PREVALVES AND RECIRC SHUTOFF VALVES CLOSED 2. ATTEMPT TO CLOSE MOV IF A.2 IS SUCCESSFUL, BSE INFORM FLIGHT AND COMMAND 3. PREVALVES AND RECIRC SHUTOFF VALVES OPEN IF A.2. IS UNSUCCESSFUL, BSE INFORM FLIGHT AND RECOMMEND NO SIVB RESTART	1. MAIN OXIDIZER VALVE POSITION (G3-401) GREATER THAN 10 DEG. 2. MAIN OXIDIZER VALVE OPEN-ON (K120-401). 3. LOX FLOWMETER FLOWRATE F1-401 GREATER THAN 47 LB/SEC. 4. LOX INJECTOR PRESSURE (D0005-401) NOTES 1. IF THE MOV IS OPEN, THE LOX PUMP INLET PRESSURE WILL GO TO ZERO AFTER COMMAND (A1). 2. THIS FAILURE WILL REQUIRE EVALUATION OF LOX RESIDUALS TO DETERMINE ADEQUACY FOR TLI VELOCITY CUTOFF (REF FMR 7-1)
	B. SECOND BURN CUTOFF	TLC	B. CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO CLOSE MOV WHEN LOX DUMP IS COMPLETE, BSE COMMAND 2. PREVALVES AND RECIRC VALVES CLOSE.	DELTA VELOCITY REQUIREMENTS

MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-5	RANGE SAFETY SYSTEM NOT SAFED AFTER INSERTION	EO		CUES---
		A. PROPELLANT DISPERSION SYSTEM NOT ARMED		A. CONTINUE MISSION BSE INFORM FLIGHT AND RECOMMEND RSO SEND SAFE COMMAND	1. FIRING UNIT 1 RS EBW GREATER THAN OR EQUAL TO 1.6 VOLTS (M30-411). 2. FIRING UNIT 2 RS EBW GREATER THAN OR EQUAL TO 1.6 VOLTS (M31-411).
		B. PROPELLANT DISPERSION SYSTEM ARMED AND RSO HAS NOT SENT MFCO		B. SPACECRAFT SEPARATION BSE INFORM FLIGHT AND 1. RECOMMEND SPACECRAFT SEPARATION TO A SAFE DISTANCE (7000 FT). 2. WHEN SPACECRAFT HAS REACHED A SAFE DISTANCE, RECOMMEND RSO SEND SAFE COMMAND.	3. RANGE SAFETY RECEIVER NO. 1 ENABLE (N57-411) BETWEEN 2.4 AND 4.5 VOLTS. 4. RANGE SAFETY RECEIVER NO. 2 ENABLE (N62-411) BETWEEN 2.4 AND 4.5 VOLTS. 5. RSO DISPLAY AND COMMAND SYSTEM STATUS. NOTES--- 1. RSO SHOULD NOT ATTEMPT TO SAFE THE RANGE SAFETY RECEIVERS ON REVS 2 AND 3 UNTIL MCC CONFIRMS THE PROPELLANT DISPERSION SYSTEM IS NOT ARMED (CONDITION A ONLY). 2. EITHER CUE 1 OR CUE 2 IS SUFFICIENT FOR IMPLEMENTING RULE B. 3. CUES 364 ARE VALID ONLY WHEN THE VEHICLE IS RECEIVING 450 MHZ RADIATION.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-6	S-IVB STAGE COLD HELIUM SHUTOFF VALVES FAIL TO CLOSE AT---			CUES---
		A. TB5 + 1.4 SEC	EARTH ORBIT	A. CONTINUE MISSION/SPACECRAFT SEPERATION BSE INFORM FLIGHT AND COMMAND--- 1. LOX NPV VALVE OPEN (REF NOTE 3) 2. ATTEMPT TO CLOSE STAGE COLD HELIUM SHUTOFF VALVES IF 2 SUCCESSFUL, BSE COMMAND IMMEDIATELY--- 3. LOX NPV VALVE CLOSE (REF NOTE 3) 4. IF LOX ULLAGE PRESSURE AT 50 PSIA OR SATURATED BSE INFORM FLIGHT AND RECOMMEND IMMEDIATE SPACECRAFT SEPERATION TO A SAFE DISTANCE.	1. LOX TANK ULLAGE PRESSURE GREATER THAN 200 PSIA (D0105-403). 2. LOX TANK ULLAGE PRESSURES (D0179-406,D0180-406). 3. COLD HELIUM BOTTLE PRESSURE DECAYING (D261-403, D0263-403). NOTES--- 1. ACTION REQUIRED TO AVOID EXCEEDING LOX TK OVER PRESS OR BULKHEAD POSTIVE DELTA PRESS LIMITS (FMR7-14). 2. SEE FMR 7-18 FOR RESTART CRITERIA FOR OFF-NOMINAL COLD HELIUM PRESSURE. 3. IF LOX NPV VALVE FAILS TO OPEN THE LOX VENT VALVE CAN BE OPENED AS BACKUP.
		B. TB7 + 1.1 SEC	TLC	B. CONTINUE MISSION AFTER TB7 + 2 MIN 30 SEC, BSE INFORM FLIGHT AND COMMAND--- 1. LOX NPV VALVE OPEN (REF NOTE 3) AT TB7 + 15 MIN BSE SEND--- 2. LOX NPV VALVE CLOSE (REF NOTE 3)	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-7	S-IVB AUXILIARY HYDRAULIC PUMP FAILS			CUES---
		A. TO TURN OFF AS SEQUENCED	EARTH ORBIT	A. CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO TURN OFF AUXILIARY HYDRAULIC PUMP AS SOON AS POSSIBLE	A.1. SYSTEM PRESSURE (D41-403). 2. RESERVOIR LEVEL (L7-403). 3. AFT BUS NO. 2 CURRENT (M22-404). 4. HYDRAULIC RESERVOIR OIL PRESSURE (D42-403). NOTES--- A.1. FAILURE IN HYDRAULIC PUMP DEPLETES AFT NO. 2 BATTERY IN APPROXIMATELY 90 MIN AND OVERHEATS HYDRAULIC SYSTEM IN APPROXIMATELY 70 MIN
		B. TO TURN ON		B. CONTINUE MISSION	CUES---
		1. AS SEQUENCED AND THE HYDRAULIC FLUID TEMP IS BELOW OR PREDICTED TO BE BELOW TO 10 DEG F BEFORE NEXT STATION AOS		BSE INFORM FLIGHT AND 1. ATTEMPT TO TURN AUXILIARY HYDRAULIC PUMP ON	B.1. SYSTEM PRESSURE (D41-403). 2. RESERVOIR OIL LEVEL (L7-403). 3. AFTER BUS NO. 2 CURRENT (M22-404). 4. RESERVOIR PRESSURE (D42-403). 5. HYDRAULIC PUMP INLET OIL TEMP (C50-401).
		2. AT TB6 + 3 MIN 39 SEC	TLI	BSE INFORM FLIGHT AND 2. COMMAND AUXILIARY HYDRAULIC PUMP OFF	6. RESERVOIR OIL TEMP (C51-403).
		C. TO TURN ON FOR LOX DUMP (J-2 ENGINE NOT CENTERED IN PITCH PLANE PRIOR TO LOX DUMP)	TLC	C. CONTINUE MISSION	C.1. ACTUATOR POSITION (G1-400) 2. SYSTEM PRESSURE (D41-403) 3. X-PHI GREATER THAN 10 DEGREES (H60-603)
		1. ENGINE GIMBAL ANGLE LESS THAN +/- 3 DEGREES		1. CONTINUE MISSION BSE INFORM FLIGHT	NOTES--- 1. THE ATTITUDE RATE LIMITS IN 7-8 DO NOT APPLY TO THIS RULE.
		2. ENGINE GIMBAL ANGLE GREATER THAN +/- 3 DEGREES		2. CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND--- 1. PREVALVES AND RECIRC VALVES CLOSED	2. A PITCH ACTUATOR DEFLECTION IN EXCESS OF +/- 3 DEGREES IS ONLY EXPECTED FOR THE FOLLOWING CONDITIONS--- (A) ERRONEOUS COMMAND SIGNAL (B) ACTUATOR FAILURE
		3. ATTITUDE ERROR GREATER THAN 10 DEGREES DURING DUMP		3. CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND--- 1. PREVALVES AND RECIRC VALVES CLOSED.	3. SINCE TWO APS ENGINES ARE AVAILABLE FOR ATTITUDE CONTROL IN THE YAW PLANE--- ATTITUDE CONTROL IN THIS PLANE WILL BE MAINTAINED FOR AN ACTUATOR IN A HARDOVER CONDITION.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-8	LOSS OF ATTITUDE CONTROL DURING			CUES---
		A. TB5	EARTH ORBIT/ TLC	A. SPACECRAFT GUIDANCE TAKEOVER/ SPACECRAFT SEPARATION	A. 1. ANGULAR RATES - PITCH (R4-602), OR YAW (R5-602) GREATER THAN 0.3 DEG/SEC AND NOT DECREASING, OR ROLL (R6-602, R12-602), GREATER THAN 0.5 DEG/SEC AND NOT DECREASING
				BSE INFORM FLIGHT AND RECOMMEND SPACECRAFT GUIDANCE TAKEOVER IF UNSUCCESSFUL, BSE RECOMMEND SPACECRAFT SEPARATION	2. ANGULAR RATES-PITCH (R13-602), OR YAW (R8-602) GREATER THAN 0.3 DEG/SEC AND NOT DECREASING, OR ROLL (R12-602) GREATER THAN 0.5 DEG/SEC AND NOT DECREASING (SEE NOTE 3)
					3. LOSS OF ATTITUDE CONTROL ALERT (SEE NOTE 2)
		B. TB6 TO TB6 + 9 MIN 20 SEC	TLI	B. TLI INHIBIT	B. 1. SAME AS A.1. ABOVE
					2. SAME AS A.2. ABOVE
				BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT	3. LOSS OF ATTITUDE CONTROL ALERT (SEE NOTE 2)
		C. TB7	TLC	C. CREW DISCRETION BSE INFORM FLIGHT AND FIDO	C. 1. SAME AS A.1. ABOVE
					2. SAME AS A.2. ABOVE
				1. DO NOT START EVASIVE MANEUVER	3. LOSS OF ATTITUDE CONTROL ALER (SEE NOTES 2 AND 4)
				2. DO NOT INITIATE TB8	
				3. BSE PERFORM NON-PROPULSIVE SIVB SAFING BY GROUND COMMAND.	

MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-8 CONT	D. TB8	TLC	D. CONTINUE MISSION BSE INFORM FLIGHT AND FIDO AND TERMINATE--- 1. LOX DUMP 2. ULLAGE ENGINE BURNS 3. LH2 CVS	D. 1. SAME AS B.1. ABOVE 2. SAME AS B.2. ABOVE 3. SAME AS B.3. ABOVE NOTES 1. IMMEDIATELY AFTER S-IVB CUTOFF, S/C RETURN OF CONTROL TO SATURN OR DURING PROGRAMMED MANEUVERS THE ABOVE RATE LIMITS ARE NOT APPLICABLE. 2. LOSS OF ATTITUDE CONTROL ALERT WILL BE GIVEN FOR THE FOLLOWING CONDITIONS--- (A) LVDC/LVDA COMPUTATIONAL FAILURE (B) ABNORMAL ATTITUDE ERROR SIGNALS (C) FAILURE TO INITIATE PROPER GUIDANCE SEQUENCE 3. THESE CUES ARE VALID IF RATE CHANNEL SWITCHOVER HAS NOT OCURRED 4. LOSS OF ATTITUDE CONTROL ALERT IS SUFFICIENT FOR IMPLEMENTING THIS RULE EXCEPT FOR PARTS B AND D

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-9	CONTINUOUS VENT SYSTEM (CVS) REGULATOR FAILS TO OPEN IN TB5 (TB5 + 59 SEC)	EARTH ORBIT TLI	CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO OPEN CVS RELIEF OVERRIDE SHUTOFF VALVE IF UNSUCCESSFUL, BSE--- 2. VENT THE LH2 TANK PRIOR TO TB6 + 8 MIN 40 SEC TO A VALUE BELOW THE PRESSURE REQUIRED FOR S-IVB RESTART. IF THE LH2 BLOWDOWN IS COMPLETED WITHIN 30 MINUTES PRIOR TO TB6 INITIATE, COMMAND--- 3. ULLAGE ENGINES ON AFTER 90 SEC OF ULLAGE SEND--- 4. ULLAGE ENGINES OFF ULLAGING SHOULD BE COMPLETED PRIOR TO THE AMBIENT REPRESSURIZATION. EARTH ORBIT IF NEITHER COMMAND ACTION(S) 1 NOR 2 IS SUCCESSFUL, BSE INFORM FLIGHT	CUES--- 1. CVS NOZZLE PRESSURE (D181-409, D182-409). 2. CVS REGULATOR CLOSED (K154-411). 3. LH2 ULLAGE PRESSURE (D177-408, D178-408). NOTES--- 1. IF THE CVS REGULATOR FAILS TO OPEN, THE LH2 SATURATION TEMPERATURE WILL INCREASE ABOVE NOMINAL RESTART LIMITS. 2. COMMAND ACTION WILL REQUIRE EVALUATION OF LH2 RESIDUALS TO DETERMINE ADEQUACY FOR TLI VELOCITY CUTOFF.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-10	APS ULLAGE ENGINE(S) THRUST FAILS TO TERMINATE AT SEQUENCED TIMES	EARTH ORBIT/ TLI/TLC	CONTINUE MISSION BSE INFORM FLIGHT AND ATTEMPT TO TERMINATE ULLAGE ENGINE THRUST IF UNSUCCESSFUL, BSE INFORM FLIGHT OF IMPENDING LOSS OF ATTITUDE CONTROL CAPABILITY	CUES--- 1. ULLAGE ENGINE THRUST CHAMBER PRESSURE (D220-414, D221-415). 2. APS HELIUM SPHERE PRESSURE DECREASING (D35-414, D36-415, D250-414, D251-415).
	7-11	IU STATE VECTOR DIFFERS FROM THE MSFN STATE VECTOR BY 6 SIGMA IU ERRORS AND CVS UNCERTAINTIES AND IS CONFIRMED BY A COMPARISON OF IMU TO MSFN	LAUNCH	CONTINUE MISSION BSE INFORM FLIGHT AND RECOMMEND IU NAVIGATION UPDATE	CUES--- 1. 6 SIGMA IU ERRORS AT T + 56 MIN. (A) DELTA A = 3.1 N.M. (B) DELTA RV = 87801 FT. (C) DELTA W DOT MAX = 16 FT/SEC WHEN DELTA W = 7277 FT. 2. 6 SIGMA IU ERRORS AT T + 1 HOUR 45 MIN. (A) DELTA A = 3.5 N.M. (B) DELTA RV = 181468 FT. (C) DELTA W DOT MAX = 16 FT/SEC WHEN DELTA W = 11338 FT.
		RULE NUMBER 7-12 IS RESERVED.			

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-13	IU ECS WATER VALVE FAILS TO CYCLE OPEN AND CLOSED	ALL	A. CONTINUE MISSION	CUES---
		A. WATER VALVE CLOSED AND COOLANT INLET CONTROL TEMPERATURE IS 64 DEG. F OR HIGHER, AND		BSE INFORM FLIGHT AND SEND--- 1. ECS LOGIC INHIBIT COMMAND	1. WATER VALVE CLOSED/OPEN (G5-601, G6-601). 2. COOLANT TEMP (C15-601). 3. GMW MODE CODE 27 BIT D8 SET TO ZERO (H60-603).
		THE INERTIAL GIMBAL TEMPERATURE IS 117 DEG.F OR HIGHER, OR THE LVDA TEMP NO.1 OR NO.2 IS 156 DEG.F OR HIGHER, OR THE LVDC MEMORY TEMP IS 124 DEG.F OR HIGHER		2. WATER VALVE OPEN	4. ST-124 INERTIAL GIMBAL TEMP (C34-603). 5. SUBLIMATOR INLET TEMP (C11-601). 6. LVDC MEMORY TEMP (C54-603). 7. LVDA TEMP NO. 1 (C55-603). 8. LVDA TEMP NO. 2 (C56-603).
		B. WATER VALVE OPEN AND COOLANT INLET CONTROL TEMP IS 55 DEG. F OR LESS, AND		B. CONTINUE MISSION BSE INFORM FLIGHT AND SEND---	
		THE INERTIAL GIMBAL TEMPERATURE IS 102 DEG. F OR LESS, OR THE LVDA TEMP NO.1 OR NO.2 IS 50 DEG. F OR LESS OR THE LVDC TEMPERATURE IS 50 DEG.F OR LESS.	EARTH ORBIT TLI TLC	1. ECS LOGIC INHIBIT COMMAND 2. WATER VALVE CLOSED	

MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-14	S-IVB STAGE COMMON BULKHEAD DELTA PRESSURE REACHES OR EXCEEDS--- A. MINUS 20 PSID OR PLUS 30 PSID B. MINUS 26 PSID OR PLUS 36 PSID	EARTH ORBIT TLC	A. CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND--- LH2 AND/OR LOX VENT VALVES OPEN OR CLOSED TO PRECLUDE REACHING SEPARATION LIMITS B. SPACECRAFT SEPARATION BSE INFORM FLIGHT AND FIDO AND RECOMMEND SPACECRAFT SEPARATION TO A SAFE DISTANCE	CUES--- 1. LH2 TANK ULLAGE PRESSURE (K177-408, D178-408). 2. LOX TANK ULLAGE PRESSURE (D180-406, D179-406) 3. LH2 PUMP INLET PRESSURE (D2-403). 4. LOX PUMP INLET PRESSURE (D3-403). NOTES--- 1. MINUS DELTA PRESSURE IS DEFINED AS A FUEL TANK ULLAGE PRESSURE GREATER THAN THE LOX TANK ULLAGE PRESSURE. 2. PLUS DELTA PRESSURE IS DEFINED AS A LOX TANK ULLAGE PRESSURE GREATER THAN THE FUEL TANK ULLAGE PRESSURE. 3. THE MINIMUM RECOMMENDED DISTANCE BETWEEN THE S-IVB AND THE SPACECRAFT IS 7,000 FT. 4. THE BULKHEAD WILL STRUCTURALLY FAIL AT THE ULTIMATE LIMITS OF MINUS 32.5 PSID OR PLUS 42.0 PSID.

MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-15	S-IVB STAGE PNEUMATIC SUPPLY PRESSURE DECAY EXCESSIVE IN TB5 OR TB7	EARTH ORBIT TLC	CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO TERMINATE PUMP PURGE AND/OR CLOSE AMBIENT HELIUM SUPPLY SHUTOFF VALVE. 2. RE-OPEN AMBIENT HELIUM SUPPLY SHUTOFF VALVE AS REQUIRED.	CUES--- 1. ENGINE PUMP PURGE PRESSURE (D50-403) 2. AMBIENT HELIUM PNEUMATIC SPHERE PRESSURE (D236-403, D256-403). 3. LOX REPRESS SUPPLY PRESSURE (D88-403, D254-403). NOTE--- 1. AN EXCESSIVE PNEUMATIC SUPPLY PRESSURE DECAY IS ONE WHICH WILL RESULT IN DEPLETION OF STAGE PNEUMATIC PRIOR TO COMPLETION OF TB8 FUNCTIONS.
		RULE 7-16 IS RESERVED			
	7-17	LOW LH2 TANK ULLAGE PRESSURE A. LH2 TANK ULLAGE PRESSURE LESS THAN 17 PSIA IN TB 5	EARTH ORBIT TLI	CONTINUE MISSION A. CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND 1. LH2 TANK VENT VALVES BOOST CLOSE ON AND OFF AND/OR CVS REGULATOR CLOSED. (ORIFICE OPEN) (NOTE 1)	CUES--- 1. LH2 ULLAGE PRESSURE (D177-408, D178-408). 2. LH2 PUMP INLET PRESSURE (D2-403). 3. LH2 VENT CLOSED DISCRETES (K1-410, K210-410). NOTES--- 1. IF THE ULLAGE PRESSURE RISES ABOVE 21 PSIA AFTER THE REGULATOR HAS BEEN CLOSED, THE REGULATOR SHOULD BE CYCLED TO MAINTAIN A 17 TO 21 PSIA ULLAGE PRESSURE IN LH2 TANK. 2. IF LH2 TANK ULLAGE PRESSURE DROPS BELOW 19.5 PSIA DURING TB5, RESULTING PROPELLANT LOSSES SHOULD BE INCLUDED IN THE EVALUATION OF CAPABILITY TO ACHIEVE ACCEPTABLE ALTERNATE MISSION PER FMR 7-1.
	7-18	LOW COLD HELIUM SUPPLY PRESSURE A. EXCESSIVE COLD HELIUM SUPPLY PRESSURE DECAY (NOTE 1)	EARTH ORBIT	A. CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND FROM LAST STATION PRIOR TO TB6-- 1. BURNER LOX SHUTDOWN VALVE CLOSE ON	CUE--- COLD HELIUM SPHERE PRESSURE (D261-403, D263-403). NOTES--- 1. AN EXCESSIVE COLD HELIUM SUPPLY PRESSURE DECAY IS ONE WHICH WILL RESULT IN A COLD HELIUM BOTTLE PRESSURE OF LESS THAN 1000 PSIA AT TB6 INITIATE OR LESS THAN 450 PSIA AT COMPLETION OF CRYOGENIC REPRESSURIZATION

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-19	LOW LOX TANK ULLAGE PRESSURE A. LOX TANK ULLAGE PRESSURE LESS THAN 31 PSIA DURING ORBITAL COAST OR EXPECTED TO BE LESS THAN 31 PSIA BY TB6 INITIATE	EARTH ORBIT	A. CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND--- 1. LOX TANK VENT VALVE BOOST CLOSE IF LOX TANK ULLAGE PRESSURE IS NOT MORE THAN 9 PSI BELOW THE REQUIRED ULLAGE PRESSURE, BSE COMMAND--- 2. AMBIENT REPRESS SYSTEM MODE SELECTOR ON AND CRYO OFF. 3. LOX TANK REPRESS CONTROL VALVE OPEN ON UNTIL TANK PRESSURE GREATER THAN REQUIRED, THEN OFF. 4. AMBIENT REPRESS SYSTEM MODE SELECTOR OFF AND CRYO ON. IF LOX TANK ULLAGE PRESSURE IS GREATER THAN 9 PSI BELOW THE REQUIRED ULLAGE PRESSURE, OR IF THE REQUIRED ULLAGE PRESSURE IS GREATER THAN THE FLIGHT CONTROL PRESSURE SWITCH SETTING, BSE COMMAND--- 5. BURNER LOX SHUTDOWN VALVE CLOSE. 6. AS CLOSE AS POSSIBLE TO TB6+7 MIN 30 SEC. LOX AMBIENT REPRESS ON	CUES--- 1. LOX ULLAGE PRESSURE (D179-406--D180-406) 2. LOX PUMP INLET PRESSURE (D3-403)

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-20	J-2 ENGINE START BOTTLE PRESSURE OUTSIDE RESTART LIMITS	EARTH ORBIT		CUES--- 1. START BOTTLE PRESSURE (D17-401, D241-401)
		A. ABOVE 1400 PSIA DURING ORBITAL COAST FOR FIRST OPPORTUNITY RESTART OR ABOVE 1500 PSIA FOR SECOND OPPORTUNITY RESTART		A. CONTINUE MISSION BSE INFORM FLIGHT AND SEND--- 1. START BOTTLE VENT OPEN FOR 3 SEC 2. REPEAT COMMAND AS NECESSARY TO INSURE A PRESSURE OF LESS THAN 1400 PSIA FOR FIRST OPPORTUNITY RESTART OR 1500 PSIA FOR SECOND OPPORTUNITY RESTART	
		B. ABOVE 1800 PSIA PRIOR TO RESTART		B. SPACECRAFT SEPARATION BSE INFORM FLIGHT AND FIDO AND RECOMMEND SPACECRAFT SEPARATION	
		C. BELOW 800 PSIA (SEE NOTE)	EARTH ORBIT	C. CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND ASAP--- 1. START TANK RECHARGE ARM ON 2. START TANK VENT OPEN UNTIL TANK PRESSURE LESS THAN 300 PSIA, THEN CLOSE	NOTES--- 1. EXCESSIVE START BOTTLE DECAY DURING ORBITAL COAST IS DEFINED AS A PRESSURE DECAY WHICH WILL RESULT IN A START BOTTLE PRESSURE BELOW 800 PSIA AT SECOND BURN ENGINE START COMMAND (TB6 + 9 MIN 30 SEC). 2. A START BOTTLE PRESSURE OF 300 PSIA MAXIMUM IS ALLOWABLE AT START BOTTLE RECHARGE COMMAND.

MISSION RULES

SECTION 7 - SLV - TB5 AND TB7

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-21	PU VALVE FAILS TO A MIXTURE RATIO GREATER THAN 5.0 TO 1 ANY TIME PRIOR TO RESTART	EARTH ORBIT/ TLI	CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND--- 1. PU VALVE HARDOVER POSITION ON (LOW EMR 4.5 TO 1) (SEE NOTE 1) IF 1 IS UNSUCCESSFUL, BSE INFORM FLIGHT AND--- 2. VENT START BOTTLE TO ACCEPTABLE LIMITS	CUES--- 1. PU VALVE POSITION (G10-401). 2. PU FEEDBACK VOLTAGE (M61-411) NOTES--- 1. THIS FAILURE WILL REQUIRE EVALUATION OF RESIDUALS TO DETERMINE ADEQUACY FOR TLI VELOCITY CUTOFF (REF FMR 7-1). 2. PU FEEDBACK VOLTAGE M61, IS ONLY VALID WHEN PU SYSTEM POWER IS ON
	7-22	S-IVB LOSS OF HYDRAULIC FLUID	ORBIT/ TLI	NO S-IVB RESTART (TB5)/TLI INHIBIT (TB6) BSE INFORM FLIGHT AND RECOMMEND NO S-IVB RESTART	CUES--- 1. HYDRAULIC RESERVOIR OIL LEVEL APPROX ZERO PERCENT (L7-403). 2. HYDRAULIC SYSTEM PRESSURE LESS THAN 1700 PSIA (D41-403). 3. HYDRAULIC RESERVOIR PRESSURE APPROXIMATELY ZERO PSIA (D42-403). NOTES--- 1. L7-403 PLUS ONE OF THE OTHER CUES ARE REQUIRED FOR IMPLEMENTATION OF THIS RULE. 2. IF ALL 3 CUES ARE FUNCTIONING PROPERLY, THEY ARE REQUIRED FOR IMPLEMENTATION OF THIS RULE.
		RULE NUMBERS 7-23 AND 7-24 ARE RESERVED.			

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-25	S-IVB STAGE LOX NONPROPULSIVE VENT (NPV) FAILS			CUES---
		A. TO OPEN AT TB7 + 0.7 SEC	TLC	A. CONTINUE MISSION BSE INFORM FLIGHT AND VENT THE LOX TANK TO 18-20 PSIA PRIOR TO TB7 + 15 MIN.	1. LOX NPV NOZZLE PRESSURES (D243-404, D244-404). 2. LOX TANK ULLAGE PRESSURE (D180-406, D179-406). 3. LOX NPV OPEN DISCRETES (K198-424, K199-424).
		B. TO LATCH OPEN AT TB8 + 23 MIN 22.2 SEC	TLC	B. CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO LATCH OPEN THE LOX VENT IF UNSUCCESSFUL, BSE COMMAND AT TB8 + 23 MIN 30 SEC.--- IF 1 IS UNSECCESSFUL, BSE COMMAND AT TB8 + 23 MIN 30 SEC--- 2. LH2 LATCHING VENT VALVE CLOSED	
	7-26	LH2 LATCHING VENT VALVE FAILS TO LATCH OPEN AS PROGRAMMED	TLC	CONTINUE MISSION BSE INFORM FLIGHT AND	CUES--- 1. LH2 NPV NOZZLE PRESSURE (D183-409, D184-409).
		A. IN TB7		1. ATTEMPT TO OPEN THE LH2 LATCHING VENT VALVE IF UNSUCCESSFUL, BSE COMMAND--- 2. LH2 LATCHING VENT VALVE CLOSED 3. LH2 VENT VALVE OPEN AT TB7 + 15 MIN OR TB7 + 1 HR 15 MIN COMMAND--- 4. LH2 VENT VALVE CLOSE	2. LH2 ULLAGE PRESSURE (D177-408, D178-408). 3. LH2 LATCHING VENT VALVE DISCRETES (K210-410, K211-410). 4. LH2 PUMP INLET PRESSURE (D2-403)
		B. IN TB8		CONTINUE MISSION BSE INFORM FLIGHT AND--- 1. ATTEMPT TO LATCH OPEN THE LH2 LATCHING VENT VALVE. IF 1 IS UNSUCCESSFUL, BSE COMMAND (ASAP) 2. LOX NPV OPEN OFF. 3. LOX VENT AND NPV BOOST CLOSE ON 4. LOX VENT AND NPV BOOST CLOSE OFF	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	7-27	ENGINE START BOTTLE DUMP FAILS TO INITIATE	TLC	CONTINUE MISSION BSE INFORM FLIGHT AND ATTEMPT TO OPEN THE START BOTTLE VENT VALVE	CUES--- 1. GH2 START BOTTLE PRESSURE (D17-401, D241-401).
	7-28	S-IVB STAGE COLD HELIUM DUMP FAILS TO INITIATE	TLC	CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO INITIATE THE COLD HELIUM DUMP THROUGH LH2 COIL ON O2/H2 BURNER. IF UNSUCCESSFUL, BSE INFORM FLIGHT AND AFTER LOX NPV OPEN IN TB8 COMMAND--- 2. LOX PRESSURIZATION SHUTOFF VALVES OPEN	CUES--- 1. COLD HELIUM BOTTLE PRESSURE (D261-403, D263-403).
		RULE NUMBERS 7-29 AND 7-30 ARE RESERVED.			

8 SLV – TB6
(RESTART)

R	ITEM	

SUMMARY OF RESTART PHASE RULES

NOTE

MISSION RULES REQUIRING GROUND SUPPORT DURING TB6 CANNOT BE IMPLEMENTED ON APOLLO 14 BECAUSE OF MSFN COVERAGE LIMITATION. THOSE RULES ARE MARKED BY AN ASTERIX.

8-1	RESERVED
*8-2	O2/H2 BURNER LH2 VALVE FAILS
*8-3	LH2 CHILLDOWN SYSTEM FAILS
*8-4	LOX CHILLDOWN SYSTEM FAILS
*8-5	RESERVED
*8-6	S-IVB ACTUATOR HARDOVER
*8-7	CONTINUOUS VENT REGULATOR FAILS TO CLOSE
8-8	LOSS OF ATTITUDE CONTROL DURING SECOND BURN

THE FOLLOWING MISSION RULES ALSO APPLY TO THIS SECTION---

6-3	INERTIAL PLATFORM FAILURE - ACCELEROMETER
6-4	LAUNCH VEHICLE INERTIAL PLATFORM FAILURE ATTITUDE REFERENCE
6-11	S-IVB STAGE LOSS OF THRUST
7-2	LOSS OF ONE APS MODULE
*7-7	S-IVB AUXILIARY HYDRAULIC PUMP FAILS
*7-8	LOSS OF ATTITUDE CONTROL DURING TB6 TO TB6 + 9 MIN 10 SEC (CREW IMPLEMENTATION)
*7-9	CONTINUOUS VENT REGULATOR FAILS TO OPEN
7-13	IU ECS WATER VALVE FAILS TO CYCLE OPEN AND CLOSED
7-14	S-IVB STAGE COMMON BULKHEAD DELTA PRESSURE REACHES OR EXCEEDS MINUS 20 PSID OR PLUS 30 PSID, MINUS 26PSID OR PLUS 36 PSID (CREW IMPLEMENTATION)
*7-16	S-IVB ENGINE CONTROL BOTTLE PRESSURE LESS THAN 400 PSIA
7-17	LH2 TANK VENT FAILURE OR LEAK DURING ORBITAL COAST
*7-18	LOW COLD HELIUM SUPPLY PRESSURE
*7-19	LOX TANK ULLAGE PRESSURE LOW (CREW IMPLEMENTATION)
*7-20	J-2 ENGINE START BOTTLE PRESSURE OUTSIDE RESTART LIMITS.
*7-21	PU VALVE FAILS TO A MIXTURE RATIO GREATER THAN 5.0 TO 1 ANY TIME PRIOR TO RESTART
*7-22	S-IVB LOSS OF ENGINE HYDRAULIC FLUID

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
		RULE 8-1 IS RESERVED.			
	8-2	S-IVB STAGE O2/H2 BURNER FUEL PROPELLANT VALVE FAILS CLOSED	TLI	CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND--- 1. BURNER SHUTDOWN 2. CONTINUOUS VENT SYSTEM ORIFICE OPEN 3. CRYO REPRESSURIZATION OFF	CUES--- 1. BURNER CHAMBER DOME TEMPERATURE (C2034-403, C382-403). 2. BURNER PROPELLANT VALVE POSITIONS (K180-404, K192-403). 3. AMBIENT REPRESSURIZATION MODE SELECT (K195-404). NOTE--- THE O2/H2 BURNER VOTING CIRCUIT WILL NOT DETECT FAILURE OF THE BURNER TO IGNITE OR BURNER FLAME-OUT IN THE EVENT THE FUEL PROPELLANT VALVE FAILS CLOSED.
	8-3	LH2 CHILLDOWN SYSTEM FAILS DURING RESTART PREPARATIONS	TLI	CONTINUE MISSION BSE INFORM FLIGHT AND--- 1. ATTEMPT TO CORRECT SITUATION SPECIFIED IN NOTE 1.A, 1.B, 1.D IF UNSUCCESSFUL, BSE INFORM FLIGHT	CUES--- 1. LH2 PUMP INLET TEMP (C3-403) 2. LH2 RECIRC FLOW (F5-404) 3. LH2 PREVALVE DISCRETES (K111-404, K112-404) 4. LH2 BLEED VALVE CLOSE (K127-401) 5. LH2 RECIRC VALVE CLOSE (K136-409) NOTES--- 1. LH2 CHILLDOWN WILL NOT BE SATISFACTORY IF--- (A) PREVALVE IS OPEN (B) RECIRCULATION VALVE IS CLOSED (C) BLEED VALVE IS CLOSED (D) CHILLDOWN PUMP IS NOT ON

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	8-4	S-IVB STAGE LOX CHILLDOWN SYSTEM FAILS DURING RESTART PREPARATIONS	TLI	CONTINUE MISSION/ TLI INHIBIT BSE INFORM FLIGHT AND--- 1. ATTEMPT TO CORRECT SITUATION SPECIFIED IN NOTES 1.A, 1.B, 1.D IF 1 IS UNSUCCESSFUL, BSE INFORM FLIGHT AND BETWEEN TB6+4 MIN 10 SEC AND TB6+7 MIN 37.8 SEC COMMAND 2. ALTERNATE SEQUENCE 6D IF LOX LEAD EXCEEDS 20 SEC, BSE INFORM FLIGHT AND 3. RECOMMEND TLI INHIBIT	CUES FOR CHILLDOWN FAILURE 1. LOX CHILLDOWN FLOW RATE (F4-424). 2. LOX ULLAGE PRESSURE TO LOX DUMP INLET PRESSURE DELTA P (D179-406,D180-406,D003-403) 3. LOX PUMP INLET TEMP NOT DECREASING(C4-403) LOX PREVALVE DISCRETES (K109-403,K110-403) LOX BLEED VALVE CLOSED (K126-401) LOX RECIRCULATION VALVE CLOSED (K139-424) CUES FOR MOV FAILURE 1. MOV POSITION GREATER THAN 10 DEG (G3-401) 2. MOV OPEN DISCRETE ON (K120-401) 3. LOX FLOWMETER (F1-401) 4. LOX INJECTOR PRESSURE (D005-401) NOTES--- 1. LOX CHILLDOWN WILL NOT BE SATISFACTORY IF--- (A) PREVALVE IS OPEN (B) RECIRCULATION VALVE IS CLOSED (C) BLEED VALVE IS CLOSED (D) CHILLDOWN PUMP IS NOT ON 2. ALTERNATE SEQ. 6D COMMAND WILL ENABLE AN ONBOARD PROGRAMMED 8 SEC. LOX LEAD BEGINNING AT TB6+7 MIN 37.8 SEC.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	8-5	RESERVED			
	8-6	S-IVB ACTUATOR CONFIRMED HARDOVER PRIOR TO TB6 + + 9 MIN 10 SEC AND AUXILIARY HYDRAULIC PUMP IS OPERATING	TLI	TLI INHIBIT BSE INFORM FLIGHT AND RECOMMEND TLI INHIBIT	CUE--- 1. ACTUATOR POSITIONS +/- 5 DEG OR GREATER (G1-400, G1-403, G2-400, G2-403). NOTE--- BOTH INDIVIDUAL ACTUATOR POSITIONS MUST CONFIRM MALFUNCTION PRIOR TO RECOMMENDING TLI INHIBIT.
	8-7	S-IVB STAGE CONTINUOUS VENT MODULE-- A. REGULATOR FAILS CLOSE DURING RESTART SEQUENCE	TLI	CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND--- 1. ATTEMPT TO CLOSE THE CVS REGULATOR IF 1 IS UNSUCCESSFUL, BSE INFORM FLIGHT AND COMMAND-- 2. O2/H2 BURNER SHUTDOWN	CUES--- A.1. CVS NOZZLE PRESSURE REMAINS GREATER THAN 3 PSIA (D181-409--D182-409) 2. CVS REGULATOR CLOSED (K154-411) 3. LH2 TANK ULLAGE PRESSURE (D177-408-- D178-408)
		B. REGULATOR FAILS TO CLOSE OR ORIFICE SHUTOFF VALVE FAILS TO CLOSE AT TB7 + 2 MIN 30.9 SEC (NOTE 1)		B. CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO CLOSE THE CVS REGULATOR OR THE CVS ORIFICE SHUTOFF VALVE IF 1 IS UNSUCCESSFUL, BSE COMMAND AT TB7 + 15 MIN AND TB7 + 1 HR 15 MIN. 2. LH2 LATCHING VENT VALVE OPEN AND LATCH	B.1. LH2 TANK CONTINUOUS VENT ORIFICE SHUTOFF VALVE CLOSED (K0155-411) 2. CVS NOZZLE PRESSURE DOES NOT DECREASE TO 0 PSIA AT TB7 + 2 MIN. 30.9 SEC. (D0181-409-- D0182-409) NOTE--- THIS FAILUE WILL REQUIRE REEVALUATION OF DELTA V REQUIRED FOR LUNAR IMPACT.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	8-8	LOSS OF ATTITUDE CONTROL DURING S-IVB SECOND BURN	TLI	CONTINUE MISSION BSE INFORM FLIGHT AND FIDO. CREW WILL TAKE ACTION ON LIMITS (NOTE 1)	CUES--- 1. ANGULAR RATES - PITCH (R4-602), YAW (R5-602), OR ROLL (R6-602) GREATER THAN 5 DEG/SEC AND NOT DECREASING 2. ANGULAR RATES-PITCH (R13-602), YAW (R8-602), OR ROLL (R12-602) GREATER THAN 5 DEG/SEC AND NOT DECREASING. (SEE NOTE 3) 3. LOSS OF ATTITUDE CONTROL ALERT (SEE NOTE2). NOTES--- 1. TLI BURN WILL BE TERMINATED FOR--- A. PITCH OR YAW BODY RATES GREATER THAN +/- 10 DEG/SEC B. ROLL BODY RATE GREATER THAN +/-20 DEG/SEC C. PITCH OR YAW ATTITUDE DEVIATION FROM NOMINAL PROFILES GREATER THAN 45 DEG 2. LOSS OF ATTITUDE CONTROL ALERT WILL BE GIVEN FOR THE FOLLOWING CONDITIONS--- (A) LVDC/LVDA COMPUTATIONAL FAILURE. (B) ATTITUDE ERROR SIGNALS ROLL GREATER THAN +/- 3.5 DEG, PITCH AND YAW GREATER THAN +/- 5 DEG. (C) FAILURE TO INITIATE PROPER GUIDANCE SEQUENCE. (D) FAILURE OF S-IVB ENGINE HYDRAULICS. 3. THE CUES ARE VALID IF RATE CHANNEL SWITCHOVER HAS NOT OCCURRED.

9 SLV - TB8 (SAFING AND LUNAR IMPACT)

R	ITEM	

SUMMARY OF SAFING AND SLINGSHOT RULES

9-1 STAGE PNEUMATIC DUMP FAILS

9-2 LOX DUMP FAILS

9-3 ENGINE CONTROL BOTTLE DUMP FAILS

9-4 RESERVED

9-5 RESERVED

THE FOLLOWING REFERENCED FLIGHT MISSION RULES ARE ALSO APPLICABLE DURING TIME BASE EIGHT (TB8)

7-3 J-2 ENGINE MAIN FUEL VALVE (MFV) FAILS TO CLOSE AT FIRST S-IVB CUTOFF, SECOND S-IVB CUTOFF

7-4 J-2 ENGINE MAIN OXIDIZER VALVE FAILS TO CLOSE AT FIRST S-IVB CUTOFF, SECOND BURN CUTOFF

7-8 LOSS OF ATTITUDE CONTROL DURING TB5 AND TB7 TO SPACECRAFT SEPARATION, TB6 TO TB6 + 9 MIN 20 SEC AFTER SPACECRAFT SEPARATION, AFTER TB8 INITIATE

7-13 IU ECS VALVE FAILS TO CYCLE OPEN AND CLOSED

7-14 S-IVB STAGE COMMON BULKHEAD DELTA PRESSURE REACHES OR EXCEEDS MINUS 20 PSID OR PLUS 30 PSID, MINUS 26 PSID OR PLUS 36 PSID.

7-25 S-IVB STAGE LOX NON-PROPULSIVE VENT (NPV) FAILS TO OPEN AT TB7 + 0.7 SEC, TO LATCH OPEN AT TB 8 + 17 MIN 3 SEC

7-26 LH2 LATCHING VENT VALVE FAILS TO LATCH OPEN AS PROGRAMMED

7-28 S-IVB STAGE COLD HELIUM DUMP FAILS TO INITIATE

MISSION RULES

SECTION 9 - SLV TB8

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	9-1	S-IVB STAGE PNEUMATIC DUMP FAILS TO INITIATE	TLC	CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO OPEN THE ENGINE PUMP PURGE CONTROL VALVE	CUES--- 1. ENGINE PUMP PURGE PRESSURE (D50-403). 2. AMBIENT HELIUM SUPPLY PRESSURE (D236-403, D256-403).
	9-2	S-IVB LOX DUMP FAILS TO INITIATE	TLC	CONTINUE MISSION BSE INFORM FLIGHT AND COMMAND THE MAIN OXIDIZER VALVE OPEN	CUES--- 1. MAIN OXIDIZER VALVE POSITION (G3-401). 2. MAIN OXIDIZER VALVE OPEN DISCRETE (K120-401). 3. LOX PUMP INLET TEMPERATURE (C4-403). 4. LOX FLOW RATE (F1-401). 5. LOX PREVALVE OPEN DISCRETE (K109-403) 6. LOX PREVALVE CLOSE DISCRETE (K110-403) NOTES--- 1. LOX DUMP WILL FAIL TO INITIATE IF--- A. THE MOV REMAINS CLOSED B. THE LOX PREVALVE REMAINS CLOSED 2. IF A LOX DUMP IS UNSUCCESSFUL A REEVALUATION OF THE LUNAR IMPACT DELTA VELOCITY WILL BE REQUIRED.
	9-3	ENGINE CONTROL BOTTLE DUMP FAILS TO INITIATE	TLC	CONTINUE MISSION BSE INFORM FLIGHT AND 1. ATTEMPT TO OPEN THE ENGINE HELIUM CONTROL VALVE	CUE--- 1. ENGINE CONTROL REG. PRESS (D18-401). 2. ENGINE CONTROL HELIUM SPHERE PRESSURE (D19-401, D242-401).
		RULES 9-4 AND 9-5 ARE RESERVED.			

R | ITEM

PRELAUNCH INSTRUMENTATION

MEASUREMENT DESCRIPTION	MEAS NUMBER	ONBOARD	TRANSDUCERS	CATEGORY	EFFECTIVITY	MISSION RULE REF
STAGE COMMUNICATIONS SYSTEM AND FLIGHT CONTROL MEASUREMENT CATEGORIZATION						
STAGE COMMUNICATIONS SYSTEM						
S-II STAGE						
LINK BP1				HD		
MUX BP1AO				HD		
MUX BP1BO				HD		
S-IVB STAGE						
LINK CP1				HD		
MUX DP1BO (VIA IU)				M		
MUX CP1BO				HD		
INSTRUMENT UNIT						
LINK DP1				HD		
LINK DP1B				M		
MUX CP1AO (VIA S-IVB)				HD		
MUX DP1AO				HD		
EMERGENCY DETECTION SYSTEM (EDS)				M		
COMMAND COMMUNICATIONS SYSTEM (CCS) UPLINK				M		
FLIGHT CONTROL MEASUREMENTS						
S-IVB STAGE						
PRESS, FUEL PUMP INLET	D2-403					7-14
PRESS, FUEL TANK ULLAGE EDS 1	D177-408	METER *	COMMON	2 OF 3		7-14
PRESS, FUEL TANK ULLAGE EDS 2	D178-408	METER *	COMMON	M		7-14/19
PRESS, OXID PUMP INLET	D3-403					
PRESS, OXID TANK ULLAGE EDS 1	D179-406	METER *	COMMON	2 OF 3		7-14/19,8-5
PRESS, OXID TANK ULLAGE EDS 2	D180-406	METER *	COMMON	M		7-14/19,8-5
INSTRUMENT UNIT						
GUIDANCE COMPUTER OPERATION	H60-603			M		6-1/4/7/9, 7-8/11,8-1/8
COMPUTER RESET PULSE NO. 1-GUIDANCE DECODER	J71-603			1 OF 2		REQUIRED TO COMPLETE MULTIPLE WORD GROUND COMMANDS
COMPUTER RESET PULSE NO. 2-GUIDANCE DECODER	J72-603			M		

*ONBOARD DISPLAY MANDATORY

10 CSM ENVIRONMENTAL CONTROL

R	ITEM	
		GENERAL
	10-1	LAUNCH LAUNCH WILL BE CONTINUED AS LONG AS THE SUIT CIRCUIT AND O2 SUPPLY WILL SUPPORT FLIGHT CREW DEMANDS FOR AT LEAST ONE REV AND ENTRY INTO 2-1. THERE ARE NO COOLANT FAILURES FOR WHICH LAUNCH/INSERTION PHASE WILL BE TERMINATED. TLC & TEC WATER EVAPORATION WILL BE LIMITED TO COMPONENT TESTING. POWERED DESCENT THERE ARE NO CSM ENVIRONMENTAL CONTROL SYSTEMS FAILURES FOR WHICH POWERED DESCENT WILL BE TERMINATED. ALL PHASES A. BACKUP SYSTEMS AND BACKUP COMPONENTS WILL NORMALLY BE USED FOR THE MOST RAPID PRACTICAL RETURN TO EARTH, NOT FOR MISSION CONTINUATION. B. LM SYSTEMS WILL BE USED AS REQUIRED FOR CSM SYSTEMS BACKUP. IF CSM SYSTEMS REQUIRE LM BACKUP THE DESCENT STAGE WILL BE RETAINED WHERE POSSIBLE. C. TO CONTINUE, WATER QUANTITY PREDICTIONS MUST REFLECT ADEQUATE QUANTITIES TO MEET NORMAL MISSION REQUIREMENTS.

R	ITEM	
	10-2	DEFINITIONS

LOSS OF CABIN INTEGRITY---

CM PRESSURE VESSEL LEAKAGE SUCH THAT CABIN PRESSURE CANNOT BE MAINTAINED GREATER THAN, OR EQUAL TO 4.5 PSIA BY CABIN PRESSURE REGULATORS (1.2 LB/HR TOTAL).

LOSS OF SUIT INTEGRITY---

TOTAL PGA AND SUIT LOOP LEAKAGE IS GREATER THAN 0.5 PSI/MIN (1.5 LB/HR) DURING PGA SUIT LOOP PRESSURE CHECK.

LOSS OF SUIT CIRCUIT---

INABILITY OF THE SUIT CIRCUIT TO MANTAIN ADEQUATE CREW COMFORT AND/OR CO2 REMOVAL WITHOUT USING DIRECT O2.

LOSS OF O2 MANIFOLD---

AN O2 MANIFOLD OR REGULATOR FAILURE WITH WHICH THE SUIT CIRCUIT O2 DEMANDS CANNOT BE SUPPLIED FOR ENTRY.

LOSS OF PRIMARY LOOP COOLING---

LOSS OF ALL FLOW, A LEAK WHICH CANNOT BE ISOLATED, OR COMBINED FAILURES SUCH THAT RADIATORS AND EVAPORATOR PROVIDE NO COOLING.

LOSS OF SECONDARY LOOP COOLING---

LOSS OF ALL FLOW, A LEAK WHICH CANNOT BE ISOLATED, OR COMBINED FAILURES SUCH THAT RADIATORS AND EVAPORATOR PROVIDE NO COOLING.

LOSS OF COOLANT LOOP RADIATORS---

RADIATOR LEAK, BLOCKAGE OF ALL FLOW THROUGH RADIATORS, OR RADIATOR DEGRADATION SUCH THAT TOTAL LONG TERM USAGE OF WATER IS MORE THAN IS BEING PRODUCED.

LOSS OF ALL COOLING---

LOSS OF PRIMARY AND SECONDARY LOOP COOLING.

LOSS OF SURGE TANK AND/OR REPRESS PACK---

SURGE TANK, REPRESS PACK, OR ASSOCIATED ISOLATABLE PLUMBING FAILURES WHICH REQUIRE ISOLATION OF THE SURGE TANK AND/OR REPRESS PACK.

RULE NUMBERS 10-3 THROUGH 10-9 ARE RESERVED.

R	ITEM	
		' SYSTEMS MANAGEMENT '
	10-10	O2 SYSTEM

A. SUIT FLOW RELIEF VALVE WILL REMAIN CLOSED FOR DURATION OF FLIGHT.

B. NORMAL CM REPRESSURIZATION WITH LM MANNED WILL UTILIZE THE REPRESS PACK.

C. THE REPRESS PACK VALVE WILL BE IN OFF POSITION FOR ALL PHASES EXCEPT LAUNCH, ENTRY, AND TUNNEL/LM PRESSURIZATION AND RECHARGE

D. THE SUIT CIRCUIT MUST BE PURGED OF ACCUMULATED H2 ONCE EVERY 6 HOURS FOR ONE MINUTE WHEN ALL CREWMEN ARE SUITED AND THE SUIT CIRCUIT IS ISOLATED.

E. THE SURGE TANK AND REPRESS PACK WILL NORMALLY BE RECHARGED SIMULTANEOUSLY.

F. CM CABIN PRESSURE WILL NOT BE ALLOWED TO DROP BELOW 4.0 PSIA DURING NORMAL LM PRESSURIZATION EXCEPT DURING TD&E.

G. THE CM ECS WILL NORMALLY SUPPLY ALL O2 FOR CONSUMPTION AND LEAKAGE DURING IVT PHASES.

H. THE FLIGHT CREW WILL DON SUITS FOR THE FOLLOWING---

1. INABILITY TO MAINTAIN CABIN PRESSURE ABOVE 4.5 PSIA.

2. ALL UNDOCKED OPERATIONS.

3. TD&E.

4. GLYCOL LEAKS IN COMMAND MODULE.

5. FIRE, SMOKE, CONTAMINATION IN CABIN.

I. THE FLIGHT CREW WILL DOFF SUITS (TIME AND CONDITIONS PERMITTING) FOR THE FOLLOWING---

1. LOSS OF SUIT CIRCUIT.

2. CONFIRMED LEAK OF GLYCOL IN SUIT CIRCUIT.

J. A LEAKING HIGH PRESSURE VESSEL IN THE CM WILL NOT BE RECHARGED.

COOLANT MANAGEMENT

A. FOR SIMULTANEOUS PRIMARY AND SECONDARY LOOP OPERATION, NORMALLY EITHER THE PRIMARY OR SECONDARY LOOP RADIATOR WILL BE ISOLATED.

B. GLYCOL RESERVOIR WILL BE ON LINE AND RADIATORS WILL BE BYPASSED FOR LAUNCH.

C. INDICATED GLYCOL ACCUMULATOR QUANTITY WILL BE MAINTAINED BETWEEN 30 AND 70 PERCENT.

D. SECONDARY COOLANT WILL BE OFF FOR LAUNCH.

E. ADDITIONAL POWER LOADS WILL BE ADDED AS REQUIRED IN AN ATTEMPT TO MAINTAIN PRIMARY RADIATOR OUTLET TEMPERATURE GREATER THAN -20 DEG.

R	ITEM
	10-10 (CONT.)

WATER SYSTEM

A. WASTE WATER WILL BE MANUALLY DUMPED OVERBOARD AS REQUIRED TO MAINTAIN INDICATED QUANTITY LESS THAN 85-90 PERCENT. WASTE WATER WILL NORMALLY BE DUMPED TO 25 PERCENT, HOWEVER, IF WASTE WATER QUANTITY INSTRUMENTATION (CF0009) IS LOST, WASTE WATER WILL BE DUMPED UNTIL POTABLE WATER QUANTITY (CF0010) BEGINS TO DECREASE.

B. WATER DUMPS WILL BE MANAGED SO THAT---

1. AT LOI, THE WASTE TANK WILL CONTAIN GREATER THAN 75 PERCENT.

2. AT CM-SM SEPARATION, THE POTABLE TANK WILL BE FULL AND THE WASTE TANK WILL BE 90 PERCENT FULL.

C. IN ORDER TO REDUCE TRAJECTORY CALCULATION PERTURBATIONS, WATER DUMPS, AND FUEL CELL PURGES WILL BE AVOIDED IF POSSIBLE---

1. BETWEEN MCC 3 AND LOI-1, PLUS TWO HOURS

2. WITHIN THREE REVS OF PRE-PDI UNDOCKING

3. BETWEEN TEI AND SEXTANT STAR CHECK PRIOR TO MCC 5

4. DURING MSFN COVERAGE IN LUNAR ORBIT (DUMPS AND PURGES SHOULD BE SCHEDULED AS CLOSE TO THE LOS MIDPOINT AS POSSIBLE)

5. WITHIN ONE HOUR PRIOR TO OPTICAL NAVIGATION SIGHTINGS

6. BETWEEN MCC 6 AND EI

D. WATER DUMPS AND FC PURGES WILL NOT BE SCHEDULED IN THE TIME FRAME 8 HRS BEFORE MCC-7.

SYSTEM BACKUP

LM SYSTEMS WILL BE USED AS REQUIRED FOR CSM SYSTEMS BACKUP. DESCENT AND/OR ASCENT STAGE WILL BE RETAINED IF POSSIBLE.

RULE NUMBERS 10-11 THROUGH
10-19 ARE RESERVED.

MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC	
	10-20	CABIN PRESSURE CANNOT BE RELIEVED	LAUNCH	CONTINUE MISSION	NORMAL RELIEF STARTS AT 50 SECONDS
	10-21	CABIN PRESSURE DECREASING AND/OR LESS THAN 4.5 PSIA AND---			CREW OPTION TO USE LM ENVIRONMENT FOR EARTH RETURN IN LIEU OF SUITED RETURN.
		A. SUIT PRESSURE GREATER THAN 3.5 PSIA	LAUNCH	A.1. CONTINUE MISSION	
			PRE-PDI	2. ENTER NEXT BEST PTP-NO GO FOR PDI. RETAIN DESCENT STAGE FOR TEI.	
			POWERED DESCENT	3. CONTINUE MISSION-NO GO FOR LUNAR STAY	
			ALL	4. ENTER NEXT BEST PTP IF CABIN PRESS NOT RESTORED GREATER THAN 4.5 PSIA.	
		B. SUIT PRESSURE LESS THAN 3.5 PSI	LAUNCH	B.1. ABORT ASAP	
			ALL	2. ENTER ASAP	
		C. LOSS OF SUIT CIRCULATION	LAUNCH	C.1. ABORT ASAP OPEN DIRECT O2 45 DEG FROM LAUNCH SETTING.	C.1. CORRESPONDS TO 12.6 LB/HR (APPROX 3 CFM/CREWMAN)
			ALL	2. ENTER ASAP	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	10-22	LOSS OF SUIT CIRCUIT, CABIN STABLE AND GREATER THAN 4.5 PSIA			LM SYSTEMS (IF AVAILABLE) WILL BE USED FOR CO2 AND H20 REMOVAL.
			LAUNCH	A. CONTINUE MISSION OPEN DIRECT O2 VALVE 45 DEG FROM LAUNCH SETTING.	A. CORRESPONDS TO 12.6 LB/HR (APPROX 3 CFM/CREWMAN)
			EO	B. ENTER NEXT BEST PTP	
				1. DOFF SUITS.	
				2. OPEN WASTE OVERBOARD DRAIN VALVE TO OBTAIN CABIN BLEED FLOW.	B.2. WASTE OVERBOARD BLEED = 1.0 LB O2/HR
				3. DON FACE MASKS AFTER 1 HOUR	3. TIME REQUIRED FOR CM C02 PARTIAL PRESSURE TO INCREASE TO 7.6 MM HG 1 CREWMAN--- 4 HR. 3 CREWMAN--- 80 MIN.
			PRE-PDI	C. ENTER NEXT BEST PTP- NO GO FOR PDI. RETAIN LM DESCENT STAGE FOR TEI.	
			POWERED DESCENT	D. CONTINUE MISSION- NO GO FOR LUNAR STAY	
			ALL	E. ENTER NEXT BEST PTP	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	10-23	LOSS OF SURGE TANK OR REPRESS PACK	ALL	A. CONTINUE MISSION	FOR LEAK IN SURGE TANK, ISOLATE SURGE TANK AND PLACE REPRESS PKG VALVE TO FILL.
	10-24	LOSS OF SURGE TANK AND REPRESS PACK	LAUNCH	A. CONTINUE MISSION	
			ALL	B. CONTINUE MISSION PLAN TO RESTORE ENTRY O2 BY STORING OPS IN CM AT FINAL LM EGRESS.	B. OPS O2 QTY--- 4 LBS/OPS (TWO OPS AVAILABLE)
			TEC	C. CONTINUE MISSION DOFF SUITS FOR ENTRY.	
	10-25	FIRE OR SMOKE IN COMMAND MODULE	LAUNCH	A. ABORT 1. DECOMPRESS CABIN 2. TROUBLESHOOT ELECTRICAL SYSTEM PER FLIGHT CREW CHECKLIST BOOST FIRE PROCEDURES.	
			PRE-PDI	B. ENTER NEXT BEST PTP-NO GO FOR PDI. RETAIN LM DESCENT STAGE FOR TEI	
			POWERED DESCENT	C. CONTINUE MISSION-NO GO FOR LUNAR STAY	
			ALL	D.1. TROUBLESHOOT/COMBAT FIRE PER FLIGHT CREW CHECKLIST EMERGENCY PROCEDURES. 2. ASSESS DAMAGE AND REMOVE POWER FROM AFFECTED SYSTEMS 3. ENTER NEXT BEST PTP RETAIN LM	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	10-26	CONTAMINATION IN CABIN	ALL	CREW MAY ELECT TO DECOMPRESS	IF UNABLE TO CLEAR CONTAMINATION, MISSION MAY BE TERMINATED EARLY.
	10-27	LOSS OF SUIT INTEGRITY	LAUNCH	A. CONTINUE MISSION	
			ALL	B. CONTINUE MISSION NO-GO FOR UNDOCK	
	10-28	LOSS OF O2 MANIFOLD A. O2 MANIFOLD LEAKS GREATER THAN 4 LB/HR AND CABIN PRESSURE GREATER THAN 4.5 PSIA	LAUNCH	A.1. CONTINUE MISSION	
			UNDOCKED PRE-PDI POWERED DESCENT/ LUNAR STAY	2. CONTINUE MISSION-	
			ALL	3. ENTER NEXT BEST PTP (A) VERIFY SURGE TANK AND REPRESS PACK ISOLATED UNTIL ENTRY.	A.3. APPROXIMATELY 5 HOURS ARE REQUIRED TO DEPLETE CABIN O2 FROM 4.8 TO 3.5 PSIA, WITH 0.456 LB/HR USAGE RATE (CREW + CABIN LEAK + TANK PRESS BLEED)
				(B) RETRIEVE OPS FROM LM, IF DOCKED	A.3.(B) CREW OPTION TO USE LM ENVIRONMENT FOR EARTH RETURN IN LIEU OF MANUAL CABIN PRESSURE REGULATION.
		B. O2 MANIFOLD LEAKS GREATER THAN 4 LB/HR AND CABIN PRESSURE LESS THAN 4.5 PSIA	LAUNCH	B.1. ABORT ASAP	
			ALL	2. ENTER ASAP USE OPS IN SUITED MODE FOR ENTRY IF PRACTICAL	LM O2 (IF AVAILABLE) MAY BE USED TO SUPPLEMENT CSM SUPPLY.
	10-29	LOSS OF ONE MAIN REGULATOR			
		A. FAILED CLOSED	LAUNCH	A.1. CONTINUE MISSION-	
			EO	2. CONTINUE MISSION- NO GO FOR TLI	
			ALL	3. CONTINUE MISSION	
		B. FAILED OPEN	ALL	B. CONTINUE MISSION	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	10-30	BOTH MAIN REGULATORS FAILED CLOSED	LAUNCH	A. CONTINUE MISSION	LM SYSTEMS (IF AVAILABLE) MAY BE USED IN LIEU OF CSM SYSTEMS
			UNDOCKED/ PRE-PDI POWERED DESCENT/ LUNAR STAY	B. CONTINUE MISSION	
			ALL	C. ENTER NEXT BEST PTP	
	10-31	LOSS OF ONE SUIT COMPRESSOR	LAUNCH	A. CONTINUE MISSION	
			EO	B. CONTINUE MISSION- NO GO FOR TLI	
			ALL	C. CONTINUE MISSION	
	10-32	LOSS OF TWO SUIT COMPRESSORS	LAUNCH	A. CONTINUE MISSION- OPEN DIRECT O2 45 DEG FROM LAUNCH SETTING	VACUUM CLEANER MAY BE CONNECTED TO SUIT LOOP BUT WILL NOT PROVIDE SUIT INTEGRITY. CONSIDERATION WILL BE GIVEN TO RETAINING LM.
			E.O.	B. CONTINUE MISSION- NO GO FOR TLI	
			TLC. LO	C. ENTER NEXT BEST PTP. NO GO FOR UNDOCKING.	
			ALL OTHER	D. CONTINUE MISSION	
		RULE NUMBERS 10-33 THROUGH 10-39 ARE RESERVED.			

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	10-40	PRIMARY COOLANT LOOP MALFUNCTIONS			
		A. LOSS OF EVAPORATOR	LAUNCH	A.1. CONTINUE MISSION	A.1.(A) MAINTAIN PRI RAD OUT TEMP GREATER THAN-20 DEG. F.
			ALL	2. CONTINUE MISSION ACTIVATE SECONDARY COOLANT LOOP WITH RADIATORS IN BYPASS AS REQUIRED TO MAINTAIN PRIMARY EVAPORATOR OUT TEMP LESS THAN 80 DEG F OR AS REQUIRED FOR CREW COMFORT	(B) WATER MANAGEMENT MAY DICTATE ACTIVATION AND DEACTIVATION OF SECONDARY LOOP TO MAINTAIN PRI RAD OUT TEMP BETWEEN 45 AND 80 DEGREES F.
		B. LOSS OF RADIATORS	LAUNCH	B.1. CONTINUE MISSION	B.1. ALTERNATE MISSION MAY BE PERFORMED
			EO	2. NO-GO FOR TLI (A) ACTIVATE SECONDARY LOOP (B) USE PRIMARY LOOP IN ADDITION TO SECONDARY LOOP FOR G&N OPERATIONS.	
			TLC	3. ENTER NEXT BEST PTP NO-GO FOR LOI	
			LUNAR ORBIT UNDOCKED/ PRE-PDI	4. BASED ON WATER AVAILABLE FOR EVAPORATIVE COOLING, CONSIDERATION WILL BE GIVEN TO CONTINUING MISSION USING SECONDARY RADIATORS SUPPLEMENTED BY PRIMARY LOOP EVAPORATOR.	
			POWERED DESCENT	5. CONTINUE MISSION	
			LUNAR STAY	6. CONTINUE MISSION. ACTIVATE SECONDARY LOOP.	
		C. TOTAL LOSS OF LOOP	LAUNCH	C.1. CONTINUE MISSION ACTIVATE SECONDARY LOOP	
			EO	2. CONTINUE MISSION NO-GO FOR TLI ACTIVATE SECONDARY LOOP	C.2. ALTERNATE MISSION MAY BE PERFORMED.
			POWERED DESCENT LUNAR STAY	3. CONTINUE MISSION- ACTIVATE SECONDARY LOOP.	
			ALL	4. ENTER NEXT BEST PTP ACTIVATE SECONDARY LOOP	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	10-41	SECONDARY LOOP MALFUNCTIONS			
		A. LOSS OF EVAPORATOR	ALL	A. CONTINUE MISSION	
		B. LOSS OF RADIATORS	EO	B.1. NO-GO FOR TLI LOOP IS STILL OPERATIONAL IN EVAPORATIVE MODE.	
			TLC	2. ENTER NEXT BEST PTP	
			LUNAR ORBIT	3. CONTINUE MISSION	
		C. TOTAL LOSS OF LOOP	EO	C.1. NO-GO FOR TLI	
			TLC	2. ENTER NEXT BEST PTP	
			LUNAR ORBIT	3. CONTINUE MISSION	
	10-42	LOSS OF PRIMARY AND SECONDARY EVAPORATORS	ALL	A. CONTINUE MISSION	
	10-43	LOSS OF ALL COOLING, PRIMARY AND SECONDARY			LM SYSTEMS (IF AVAILABLE) WILL BE USED TO SUPPLEMENT CSM OPERATIONS.
			LAUNCH	A. CONTINUE MISSION	
			EO	B. ENTER NEXT BEST ATP OR PTP MAXIMUM ORBIT TIME--- 4 HOURS EMERGENCY POWER DOWN FOLLOWED BY 1.5 HOURS OF POWER UP FOR ENTRY.	B. LOSS OF TWO FUEL CELLS POWER DOWN.
			POWERED DESCENT	C. CONTINUE MISSION-	
			ALL	D. ENTER ASAP	

MISSION RULES

SECTION 10 - CSM ENVIRONMENTAL CONTROL SYSTEM

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	10-44	CONFIRMED LEAK OF GYLCOL COOLANT			LM ENVIRONMENT (IF AVAILABLE) MAY BE USED FOR EARTH RETURN IN LIEU OF CSM.
		A. IN COMMAND MODULE	LAUNCH	A.1. CONTINUE MISSION	
			EO	2. ENTER NEXT BEST PTP DON SUITS. PURGE SUIT LOOP WITH DIRECT O2.	
			POWERED DESCENT	3. CONTINUE MISSION- NO GO FOR LUNAR STAY	
			ALL	4. ENTER NEXT BEST PTP	
		B. IN SUIT CIRCUIT	LAUNCH	B.1. CONTINUE MISSION	
			EO	2. ENTER NEXT BEST PTP DOFF SUITS AND USE FACE MASKS IF REQUIRED.	
			POWERED DESCENT	3. CONTINUE MISSION NO GO FOR LUNAR STAY	
			ALL	4. ENTER NEXT BEST PTP	
		RULE NUMBERS 10-45 THROUGH 10-49 ARE RESERVED.			

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	10-50	LOSS OF OVERBOARD DUMPS			
		A. NORMAL OVERBOARD DUMPS FROZEN OR BLOCKED	ALL	A. CONTINUE MISSION	A.1. UTILIZE AUXILIARY DUMP FOR URINE AND WASTE WATER DISPOSAL. 2. BLEED O2 FROM WATER TANK THROUGH WASTE MANAGEMENT OVERBOARD DRAIN VALVE INTO CABIN.
		B. LOSS OF ALL OVERBOARD DUMP CAPABILITY	EO TLC LUNAR ORBIT	B.1. ENTER NEXT BEST PTP	B.1.(A) IF POTABLE AND WASTE TANKS (OR WASTE TANKS ALONE) BECOME FULL, FORCED WATER BOILING WILL BE NECESSARY TO ALLOW FUEL CELL AND/OR CYCLIC ACCUMULATOR OPERATION. (B) LM URINE STORAGE BAGS (IF AVAILABLE) WILL BE USED.
			UNDOCKED/ PRE-PDI/ POWERED DESCENT/ LUNAR STAY	2. CONTINUE MISSION	2. UNDOCKING MAY BE PERFORMED.
	10-51	UNCONTROLABLE HIGH HUMIDITY			LM SYSTEMS MAY BE USED FOR HUMIDITY CONTROL.
			LAUNCH	A. CONTINUE MISSION	
			PRE-PDI	B. ENTER NEXT BEST PTP- NO GO FOR PDI. RETAIN LM DESCENT STAGE FOR TEI	
			POWERED DESCENT	C. CONTINUE MISSION- NO GO FOR LUNAR STAY	
			ALL	D. ENTER NEXT BEST PTP	
	10-52	WASTE WATER TANK LEAK OR LOSS OF WASTE WATER STORAGE CAPABILITY			LM SYSTEMS (IF AVAILABLE) MAY BE USED TO SUPPLEMENT CSM WHEN POTABLE WATER TANK BECOMES FULL, FUEL CELL WATER WILL BE DUMPED THROUGH OVERBOARD PRESSURE RELIEF VALVES
			ALL	CONTINUE MISSION	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	10-53	CONFIRMED LEAK IN POTABLE WATER TANK OR UNABLE TO TRANSFER FUEL CELL WATER TO POTABLE TANK.			LM SYSTEMS (IF AVAILABLE) MAY BE USED TO SUPPLEMENT CSM. WATER STORAGE BAG(S) MAY BE USED TO CONTINUE EARTH ORBIT MISSION.
			LAUNCH	A. CONTINUE MISSION	
			EO	B. CONTINUE MISSION GO FOR TLI. ENTER NEXT BEST PTP AFTER TANK DEPLETION IF TLI NOT PERFORMED AND UNABLE TO EXTRACT LM	
			TLC, LO, UNDOCKED, PRE-PDI, POWERED DESCENT, LUNAR STAY	C. CONTINUE MISSION- USE LM WATER FOR CREW CONSUMPTION. IF UNABLE TO DO TD&E ENTER NEXT BEST PTP.	
		RULE NUMBERS 10-54 THROUGH 10-59 ARE RESERVED.			

R	ITEM	INSTRUMENTATION REQUIREMENTS				
	10-60	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCER	CATEGORY	REFERENCE
		CABIN PRES	CF0001P	METER	COMMON	1 OF	10-20
		SUIT PRES	CF0012P	METER	COMMON	3 M	
		TANK BLADDER PRES	CF0120P	-----	------		
		SUIT PRESS (CUFF GAGES)	-------	-----	------	MANDATORY (EACH CREWMAN)	10-21
		SURGE TANK PRESS	CF0006P	METER	COMMON	1 OF	10-28
		OXYGEN REPRESS PRESS	-------	METER	------	2 M	
		PRIM ACCUM QTY	CF0019Q	METER	COMMON	1 OF	10-40,
		PRIM PUMP OUT PRESS	CF0016P	METER	COMMON	2 M	10-44
		POTABLE H2O QTY	CF0010Q	METER	COMMON	HD	10-53,
		WASTE H2O QTY	CF0009Q	METER	COMMON	HD	10-52
		SEC STEAM PRESS	CF0073P	METER	COMMON	HD	10-41
		SEC EVAP OUT TEMP	CF0071T	METER	COMMON	HD	
		SEC ACCUM QTY	CF0072P	METER	COMMON	HD	
		SEC PUMP OUT PRESS	CF0070P	METER	COMMON	HD	
		PRIM EVAP OUT TEMP	CF0018T	METER	COMMON	HD	
		PRIM STEAM PRESS	CF0034	METER	COMMON	HD	
		ECS O2 FLOW	CF0035R	METER	COMMON	HD	
		O2 MANIFOLD PRESS	CF0036P	-----	------	HD	
		SUIT COMP PRESS	CF0015P	METER	COMMON	HD	
		PRIM RAD OUT TEMP	CF0020T	METER	COMMON	HD	
		PRIM EVAP INLET TEMP	CF0181T	-----	------	HD	
		STEAM DUCT TEMP	CF0017T	-----	------	HD	
		SEC RAD OUT TEMP	SF0236T	METER	------	HD	

11 CSM CRYOGENICS

R	ITEM	
		' GENERAL '
	11-1	LAUNCH THERE ARE NO CRYO FAILURES FOR WHICH THE LAUNCH/INSERTION PHASE WILL BE TERMINATED. FOR COMPLETE LOSS OF THE SYSTEM RESULTING IN THREE FUEL CELL FAILURES, ENTRY WILL BE PLANNED INTO PTP 3-1. THREE ENTRY BATTERIES AND THE AUX BATT ARE CAPABLE OF SUPPORTING THE LAUNCH, AS MUCH AS 3 REVS POWERED UP, AND ENTRY.
	11-2	ALL PHASES THE CRYOGENICS SYSTEM IS REQUIRED UNTIL CM/SM SEP SO THAT THE ENTRY AND LANDING PHASES WILL BE ENTERED INTO WITH FULL CONSUMABLES POTENTIAL, THAT IS, FULLY CHARGED ENTRY BATTERIES AND ENTRY O2 TANKS. IF THIS CAPABILITY IS POTENTIALLY JEOPARDIZED BY CRYO SYSTEMS DEPLETION OR MALFUNCTION, MISSION TERMINATION PROCEDURES WILL BE ENACTED IN WHATEVER TIME FRAME IS APPROPRIATE OR AVAILABLE. ANY ENTRY BATTERY OR ENTRY O2 USAGE AFTER LOSS OF RECHARGE CAPABILITY FROM THE CRYO SYSTEM WILL REDUCE SUPPLY AVAILABLE FOR ENTRY, LANDING, AND POSTLANDING.
	11-3	POWERED DESCENT THERE ARE NO CRYO SYSTEM FAILURES FOR WHICH POWERED DESCENT WILL BE TERMINATED.
	11-4	LOSS OF CRYOGENIC TANK IS DEFINED AS--- A. PRESSURE CANNOT BE MAINTAINED ABOVE 150 PSIA FOR O2 AND 100 PSIA FOR H2. B. A LEAK, WHICH COMBINED WITH A 40 AMP LOAD FLOW FROM THE TANK, WILL DEPLETE THE TANK BEFORE CM/SM SEP. C. LOSS OF ALL HEATERS IN AN O2 TANK LOSS OF 2 HEATERS AND ONE FAN IN A H2 TANK.
	11-5	LUNAR MISSION WILL BE CONTINUED IF A. ENOUGH H2 IS MAINTAINED IN THE LOWEST TANK TO PERFORM AN EARTH RETURN FROM ANY POINT WITH AT LEAST AN AVERAGE POWER LEVEL OF 40 AMPS. B. THE O2 TANKS MEET REDLINE CRITERIA AND THE LOWEST TWO TANKS ARE CAPABLE OF SUPPORTING AN EARTH RETURN FROM ANY POINT WITH AT LEAST AN AVERAGE POWER LEVEL OF 40 AMPS.
	11-6	EARTH ORBIT MISSION WILL BE CONTINUED AS LONG AS ENOUGH TOTAL CRYO (O2,H2) IS AVAILABLE TO PERFORM AN ENTRY INTO THE NEXT DAILY GO/NO GO AREA.
		RULE NUMBERS 11-7 THROUGH 11-9 ARE RESERVED.

R	ITEM	
		' SYSTEMS MANAGEMENT '
	11-10	CRYO MANAGEMENT
		A. NORMALLY, TANK PRESSURES WILL BE MAINTAINED BY USE OF TANK HEATERS IN 'AUTO' MODE
		B. MANUAL PRESSURE CONTROL WILL NORMALLY BE USED AS REQUIRED TO MAINTAIN---
		1. TANK PRESSURES GREATER THAN 750 PSIA O2 AND 200 PSIA FOR H2.
		2. H2 QUANTITY BALANCE WITHIN 3 PERCENT
		3. O2 QUANTITY BALANCE BETWEEN THE TWO HIGH TANKS TO MAINTAIN A SINGLE TANK RETURN AT AN AVERAGE FUEL CELL POWER LEVEL OF 40 AMPS ON EITHER OF THESE TANKS
		C. ONE FUEL CELL MAY BE PURGED OR THE SPACECRAFT ELECTRICAL LOADS MAY BE INCREASED TO PRECLUDE CRYO TANK VENTING.
		D. H2 TANK FANS WILL NOT BE OPERATED IN THE AUTO MODE.
		E. O2 TANK 3 ISOLATION VALVE WILL NORMALLY REMAIN OPEN
	11-11	CRYO GAGING
		A. ONBOARD CRYOGENIC QUANTITY GAGING IS PRIME. ACCURACY IS +/-2.65 PERCENT (+/-8.48 LB O2, +/-0.72 LB H2) PER TANK. INSTANTANEOUS O2 QUANTITY ACCURACIES MAY BE DEGRADED FROM THESE NUMBERS DUE TO LACK OF TANK FANS.
		B. MCC CALCULATED QUANTITY USING PRESSURE VERSUS TEMPERATURE IS BACKUP.
		RULE NUMBERS 11-12 THROUGH 11-19 ARE RESERVED.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC MISSION RULES	
	11-20	LOSS OF ONE O2 TANK	LAUNCH	A. CONTINUE MISSION	LM, PLSS, AND OPS O2 WILL BE USED AS REQUIRED TO SUPPLEMENT CSM O2.
			EO	B. CONTINUE MISSION NO-GO FOR TLI	
			ALL	C. CONSIDERATION WILL BE GIVEN TO CONTINUING THE MISSION AFTER LOSS OF A TANK IF OTHER TWO TANKS MEET REDLINE CRITERIA.	
			POST DOCK	JETTISON LM	
	11-21	LOSS OF TWO O2 TANKS	LAUNCH	A. CONTINUE MISSION	
			E.O.	B. CONTINUE MISSION NO GO FOR TLI	
			POWERED DESCENT	C. CONTINUE MISSION NO GO FOR LUNAR STAY	
			ALL	D. ENTER NEXT BEST PTP RETAIN LM	
	11-22	LOSS OF ONE H2 TANK	LAUNCH	A. CONTINUE MISSION	
			E.O.	B. CONTINUE MISSION	
			TLC	C. NO GO TLI NO GO LOI	
			PWRD DESCENT	D. CONTINUE MISSION NO GO LUNAR STAY	
			ALL	E. ENTER NEXT BEST PTP JETTISON LM.	
	11-23	LOSS OF 3 O2 TANKS AND/OR 2 H2 TANKS	LAUNCH	A. CONTINUE MISSION ISOLATE SURGE TANK BEFORE 800 PSIA	AUX BATTERY WILL POWER SMJC'S.
			TLC	B. ENTER NEXT BEST PTP. NO GO FOR LOI	
			PWRD DESCENT	C. CONTINUE MISSION NO GO FOR LUNAR STAY	
			ALL	D. ENTER NEXT BEST PTP, RETAIN LM	
		RULE NUMBERS 11-24 THROUGH 11-49 ARE RESERVED.			

R | ITEM

INSTRUMENTATION REQUIREMENTS

ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
11-50	O2 TANK 1 QTY	SC0032Q	METER	COMMON	2 OF 3	11-20
	O2 TANK 2 QTY	SC0033Q	METER	COMMON	MANDATORY	21,22
	O2 TANK 3 QTY	SC0051Q	METER	COMMON		
	O2 TANK 1 TEMP	SC0041T	-----	------	HIGHLY	11-20
	O2 TANK 2 TEMP	SC0042T	-----	------	DESIRABLE	21,22
	O2 TANK 3 TEMP	SC0055T	-----	------		
	H2 TANK 1 QTY	SC0030Q	METER	COMMON	1 OF 2	11- 21,22
	H2 TANK 2 QTY	SC0031Q	METER	COMMON	MANDATORY	
	H2 TANK 1 TEMP	SC0043T	-----	------	HIGHLY	11-21,22
	H2 TANK 2 TEMP	SC0044T	-----	------	DESIRABLE	
	O2 TANK 1 PRESS	SC0037P	METER	COMMON	2 OF 3	11-20,21,22
	O2 TANK 2 PRESS	SC0038P	METER	COMMON	MANDATORY	11-20,21,22
	O2 TANK 3 PRESS	SC0053P	METER	COMMON		
	H2 TANK 1 PRESS	SC0039P	METER	COMMON	1 OF 2	11-21,22
	H2 TANK 2 PRESS	SC0040P	METER	COMMON	MANDATORY	11- 21,22
	O2 TANK 2 AND 3 MAN. PRESS	SC0069P	C+W	COMMON	HD	
	O2 TANK 1 HTR TEMP	SC0070T	METER	COMMON	HD	11-23
	O2 TANK 2 HTR TEMP	SC0071T	METER	COMMON	HD	11-23
	O2 TANK 3 HTR TEMP	SC0072T	METER	COMMON	HD	11-23

NOTE---PRESSURE OR QUANTITY MEASUREMENT REQUIRED IN EACH CRYO TANK.

12 CSM ELECTRICAL POWER SYSTEM

R	ITEM	
		' GENERAL '
	12-1	LAUNCH A. LAUNCH WILL BE CONTINUED AS LONG AS SUFFICIENT ENERGY IS AVAILABLE TO PERFORM AN ENTRY INTO AT LEAST PTP 2-1. THERE MUST BE AT LEAST ONE MAIN BUS AND ONE AC BUS (THROUGH MODE I AND II REGIONS) OPERATIONAL TO CONTINUE. B. THE LAUNCH PHASE WILL NOT BE TERMINATED AS LONG AS THREE ENTRY BATTERIES REMAIN TO SUPPLY MAIN BUS LOADS OR ONE ENTRY BATTERY AND ONE SM POWER SOURCE REMAIN.
	12-2	POWERED DESCENT THERE ARE NO EPS FAILURES FOR WHICH POWERED DESCENT WILL BE TERMINATED.
	12-3	ALL PHASES THE MISSION WILL BE CONTINUED AS LONG AS THE REQUIRED NUMBER OF FUEL CELLS ARE AVAILABLE AND ARE CAPABLE OF SUPPORTING MISSION REQUIREMENTS OF 75 TO 90 AMPS (WITHOUT BATTERY SUPPLEMENT EXCEPT DURING SPS DELTA V'S) AND THREE GOOD ENTRY BATTERIES REMAIN.
	12-4	BATTERY IS CONSIDERED FAILED IF--- A. LAUNCH- A BATTERY BUS VOLTAGE IS 0.5 VOLTS LESS THAN THE CORRESPONDING MAIN BUS. B. ORBIT- AN ENTRY BATTERY OUTPUT IS LESS THAN 3 AMPS WHEN CONNECTED TO A MAIN BUS DURING SPS MANEUVERS (NOMINAL TOTAL BATTERY CURRENT FOR SPS MANEUVERS IS 20 +/- 2 AMPS). C. SUSTAINED BATTERY CHARGER OUTPUT TO AN ENTRY BATTERY IS GREATER THAN 2.0 AMPS AND ALL LOADS REMOVED. D. THE AUX. BATTERY CANNOT SUPPORT REQUIRED MAIN BUS LOADS.
	12-5	AN AC BUS IS CONSIDERED FAILED IF ANY TWO PHASES CANNOT BE MAINTAINED GREATER THAN 95 VOLTS.
	12-6	AN INVERTER IS CONSIDERED FAILED IF--- A. OUTPUT VOLTAGE ON ANY PHASE IS GREATER THAN 130 VAC. B. OUTPUT VOLTAGE ON ANY TWO PHASES IS LESS THAN 95 VAC.
	12-7	FUEL CELL IS CONSIDERED FAILED FOR MISSION PLANNING IF--- A. FUEL CELL CANNOT SUPPLY SUFFICIENT POWER TO MEET ITS OWN PARASITIC LOADS (5 AMPS PLUS INLINE HEATER POWER AS REQUIRED). B. FUEL CELL H2 LOOP IS CONTAMINATED WITH KOH. C. REGULATED H2 PRESSURE IS LESS THAN 36.7 PSIA (CORRESPONDS TO N2 PRESSURE SHIFT DOWN TO 28.2 PSIA FOR CRITICAL OPERATION- LOWER N2 PRESSURE CAN BE MANAGED BY TURNING OFF H2O TANK PRESSURE).
	12-8	TLI MINIMUM PURGE CAPABILITY IS BOTH OXYGEN AND HYDROGEN ON ONE FUEL CELL AND AT LEAST OXYGEN ON ONE OTHER FUEL CELL.

R	ITEM	
		RULE NUMBERS 12-9 THROUGH 12-19 ARE RESERVED.

R	ITEM	

SYSTEMS MANAGEMENT

12-20 BUS MANAGEMENT

A. ONE AND ONLY ONE FUEL CELL WILL BE TIED TO BOTH MAIN BUSES.

B. INVERTERS WILL BE CONFIGURED SUCH THAT MAIN BUS A WILL SUPPLY AC BUS 1 AND MAIN BUS B WILL SUPPLY AC BUS 2.

C. MAIN BUS VOLTAGE WILL BE MAINTAINED GREATER THAN 26.5 VDC AND LESS THAN 31 VDC. ONE FUEL CELL MAY BE OPEN CIRCUITED FOR OPTIMUM VOLTAGE AND POWER MANAGEMENT.

D. THE BATTERY CHARGER WILL BE USED TO CHECK OUT A SUSPECTED SHORTED BUS (EXCEPT MAIN BUSES) AFTER ALL EQUIPMENT AND POWER SOURCES HAVE BEEN REMOVED FROM BUS.

E. MINIMUM MAIN BUS VOLTAGE WILL BE MAINTAINED TO BE COMPATIBLE WITH ONLINE OPERATION EQUIPMENT.

1.	SPS	24.5
2.	PGNS	25.0
3.	AUTO SM-RCS	22.0
4.	AUTO CM-RCS	21.0
5.	DIRECT SM-RCS	21.0
6.	DIRECT CM-RCS	17.0
7.	INVERTERS	19.0

12-21 BATTERY MANAGEMENT

A. BATTERIES A AND B WILL BE USED TO SUPPLEMENT MAIN BUS LOADS FROM T-75 SECONDS TO INSERTION.

B. BATTERIES A AND B WILL BE USED TO SUPPLEMENT MAIN BUS LOADS FOR SPS MANEUVERS. BATTERY C WILL BE ROTATED TO MAINTAIN BATTERY BALANCE IN THE EVENT THE BATTERY CHARGER FAILS.

C. BATTERY CHARGING WILL BE TERMINATED FOR ONE OF THE FOLLOWING, WHICHEVER OCCURS FIRST---

1. INTEGRATED AMP-HOURS INTO BATTERY BY CHARGER EQUALS INTEGRATED AMP-HOURS OUT OF BATTERY BY LOADS.

2. WHEN BATTERY CHARGER CURRENT DECREASES TO 0.62 AMPS (CORRESPONDS TO 39.5 VDC AT THE BATTERY BUS)

D. THREE BATTERIES WILL BE TIED TO THE MAIN BUSES FOR DEORBIT MANEUVER AND ENTRY.

E. BATTERIES ARE CONSIDERED TO HAVE 40 AMP-HR CAPABILITY INFLIGHT AND 45 AMP-HR CAPABILITY FOR POSTLANDING.

F. A SINGLE BATTERY THAT CANNOT BE RECHARGED WILL NOT BE USED EXCEPT DURING DEORBIT, ENTRY AND POSTLANDING.

G. BATTERY VENT VALVE WILL REMAIN CLOSED UNLESS MANIFOLD PRESSURE IS GREATER THAN 6 PSIA. VENTING OPERATION WILL BE ALLOWED TO TROUBLESHOOT A SUSPECTED FROZEN DUMP.

H. THE AUX BATTERY WILL NOT BE USED FOR NORMAL MISSION OPERATIONS.

R	ITEM	
	12-22	FUEL CELL MANAGEMENT

A. FUEL CELL WILL BE ''SHUTDOWN'' FOR THE FOLLOWING---

1. SUSTAINED CURRENT OUTPUT LESS THAN 5 AMPS.
2. FUEL CELL H2 LOOP IS CONTAMINATED WITH KOH.
3. REACTANT LEAKAGE JEOPARDIZING MISSION DURATION.

B. FUEL CELL MAY BE ''OPEN CIRCUITED'' FOR THE FOLLOWING---

1. SKIN TEMP GREATER THAN 475 DEG. F.
2. TCE TEMP GREATER THAN 225 DEG. F.
3. FAILURE OF H2 PUMP OR GLYCOL PUMP.
4. VOLTAGE MANAGEMENT.
5. FUEL CELL CANNOT BE PURGED AND TIME TO GO IS GREATER THAN PREDICTED FUEL CELL LIFETIME.

C. FUEL CELL O2 AND H2 PURGES WILL NORMALLY BE PERFORMED AT 12 AND 48 HOUR INTERVALS, RESPECTIVELY. HOWEVER, THE INTERVALS WILL BE FLEXIBLE TO COINCIDE WITH WATER DUMPS (REF. MR 10-10 C).

D. ADDITIONAL PURGES WILL BE INITIATED AS OPERATIONAL CONDITIONS DICTATE.

E. FUEL CELLS WILL NOT BE PURGED FOR CONFIRMED HIGH PH INDICATION.

F. EACH H2 PURGE WILL NORMALLY BE PRECEDED BY 20 MINUTES OF H2 VENT HEATER OPERATION FOLLOWED BY 10 MIN OF HEATER OPERATION AFTER PURGE COMPLETION.

G. FC INLINE HEATERS WILL NORMALLY OPERATE IN ''AUTO'' CONTINUOUSLY.

H. REACTANT VALVES MUST REMAIN OPEN AT ALL TIMES UNLESS THE FUEL CELL IS DECLARED FAILED.

I. ADDITIONAL POWER LOADS WILL BE ADDED AS REQUIRED TO MAINTAIN FC RAD OUT TEMP GREATER THAN -40 DEG. IF CRYO BUDGET JEOPARDIZED OR RAD OUT TEMPS NOT MAINTAINED GREATER THAN -40 DEG, FC RAD WILL BE PLACED IN EMERGENCY BYPASS.

J. ONE FUEL CELL MAY BE PURGED TO PRECLUDE VENTING OF CRYO TANKS OR FOR CRYO PRESSURE MANAGEMENT.

K. IF IT BECOMES OPERATIONALLY NECESSARY TO SHUTDOWN OR OPEN CIRCUIT A FUEL CELL, FUEL CELL 2 WILL BE SELECTED.

	12-23	INVERTER MANAGEMENT

INVERTERS MAY BE REMOVED FROM LINE FOR ANY OF THE FOLLOWING REASONS---

A. INVERTER TEMP GREATER THAN 190 DEG. F.

B. SPACECRAFT LOAD MANAGEMENT.

RULE NUMBERS 12-24 THROUGH
12-29 ARE RESERVED

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC MISSION RULES	
	12-30	LOSS OF ONE FUEL CELL (OUTPUT LESS THAN 5 AMPS)	LAUNCH	A. CONTINUE MISSION 1. IF LOSS IS FC 3 OPEN CIRCUIT AND CONFIGURE FC 2 TO MAIN BUS B ONLY.	BAT C WILL USED TO SUPPLEMENT MAIN BUSES LOADS DURING SPS BURNS TO BACK UP ANY SUBSEQUENT FUEL CELL FAILURES. BAT C MAY BE TIED TO EITHER OR BOTH BUSES.
			E.O.	B. NO-GO FOR TLI 1. OPEN CIRCUIT FUEL CELL 2. IF LOSS IS FC 3 CONFIGURE FC 2 TO MAIN BUS B ONLY. 3. IF FUEL CELL CANNOT BE RESTORED, PERFORM SHUTDOWN.	
			TLC, L.O., LUNAR STAY	C. BASED ON FAILURE MODE, CONSIDERATION WILL BE GIVEN TO CONTINUING WITH NOMINAL MISSION.	
			ALL	CONTINUE MISSION	
	12-31	LOSS OF TWO FUEL CELLS (OUTPUT LESS THAN 5 AMPS EACH)	LAUNCH	A. CONTINUE MISSION AFTER 2 + 00 GET PERFORM 1. EDS AUTO/OFF TO OFF. 2. TIE BAT C TO BOTH MAIN BUSES.	LM SYSTEMS MAY BE USED TO SUPPLEMENT CSM POWER. 2. AUX. BATTERY MAY BE USED IN LIEU OF BATT C
			POWERED DESCENT	B. CONTINUE MISSION NO GO FOR LUNAR STAY	
			ALL	C. ENTER NEXT BEST PTP 1. CONNECT REMAINING FUEL CELL TO BOTH MAIN BUSES. 2. PERFORM POWER DOWN TO MAINTAIN MAIN BUS VOLTS GREATER THAN 24.5 VDC	C. ONE ENTRY BATTERY OR AUX BATT MAY BE USED TO SUPPLEMENT REMAINING FC FOR G+N ALIGNMENT PRIOR TO DEORBIT. 2. REF. CREW EMERGENCY POWERDOWN PROCEDURE.

MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	12-32	LOSS OF THREE FUEL CELLS			LM SYSTEMS (IF AVAILABLE) MAY BE USED TO SUPPLEMENT FUEL CELL POWER.
		A. OUTPUT LESS THAN 10 AMPS EACH	LAUNCH	A. CONTINUE MISSION	
				1. AFTER 2 + 00 EDS AUTO/OFF TO OFF.	
				2. TIE BAT C TO BOTH MAIN BUSES.	
				3. TIE AUX. BATT TO MAIN A.	A.3. 4.75 HOURS LEFT IN ORBIT BEFORE DEORBIT MANEUVER.
				4. ENTER 3-1 AT NORMAL POWER IF FUEL CELLS CANNOT BE RESTORED.	
			POWERED DESCENT	B. CONTINUE MISSION NO GO FOR LUNAR STAY	
			ALL	C. ENTER NEXT BEST PTP	
	12-33	LOSS OF ALL SM POWER PLUS ONE ENTRY BATTERY CURRENT LESS THAN 50 PERCENT OF LOAD ON EITHER REMAINING BATTERY			USE LM SYSTEMS (IF AVAILABLE). RESERVE ENTRY BATTERIES FOR ENTRY.
			LAUNCH	A. ABORT	A. ASSUMES ALL THREE FUEL CELL CURRENTS LESS THAN OR EQUAL TO 5 AMPS AND BATTERY C TIED TO BOTH MAINS.
			EO	B. ENTER NEXT BEST ATP OR PTP PERFORM EMERGENCY POWER DOWN	B. 2.4 HOURS LEFT IN ORBIT BEFORE SPS IGNITION
			POWERED DESCENT	C. CONTINUE MISSION NO GO FOR LUNAR STAY	
			ALL	D. ENTER NEXT BEST PTP PERFORM EMERGENCY POWER DOWN	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	12-34	DEGRADED FUEL CELLS-(UNABLE TO SUPPORT NORMAL DRIFTING FLIGHT LOADS - SCS & G&N POWERED DOWN- AND MAINTAIN MN BUS VOLTAGE GREATER THAN 26.5 VDC)	LAUNCH	A. CONTINUE MISSION-	
			POWERED DESCENT	B. CONTINUE MISSION NO GO FOR LUNAR STAY	
			ALL	C. ENTER NEXT BEST PTP-	
		RULE NUMBERS 12-35 THROUGH 12-39 ARE RESERVED.			

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	12-40	LOSS OF ONE ENTRY BATTERY (OUTPUT LESS THAN 3 AMPS WHEN TIED TO MAIN BUS)	LAUNCH	A. CONTINUE MISSION 1. EDS AUTO/OFF TO OFF. 2. IF LOSS OF BAT A, TIE BAT C TO MAIN A. 3. IF LOSS OF BAT B, TIE BAT C TO MAIN B.	
			EO	B. NO-GO FOR TLI	B. IF LOST DURING SPS MANEUVER, CONTINUE ON REMAINING BATTERY.
			ALL	C. BASED ON FAILURE MODE, CONSIDERATION WILL BE GIVEN TO CONTINUING NOMINAL MISSION.	
	12-41	LOSS OF TWO ENTRY BATTERIES (OUTPUT LESS THAN 3 AMPS EACH WHEN CONNECTED TO MAIN BUS)	LAUNCH	A. CONTINUE MISSION AS LONG AS ONE SM POWER SOURCE REMAINS. 1. EDS AUTO/OFF TO OFF. 2. ENTER NEXT BEST PTP	
			PRE-PDI	B. ENTER NEXT BEST PTP-NO GO FOR PDI	
			POWERED DESCENT	C. CONTINUE MISSION-NO GO FOR LUNAR STAY	
			ALL	D. ENTER NEXT BEST PTP USE ONE BATTERY ENTRY PROCEDURE.	D. IF LOSS DURING SPS MANEUVER, ATTEMPT TO TIE BATTERY C TO BOTH MAINS.
	12-42	LOSS OF BATTERY CHARGER	EO	A. CONTINUE MISSION ROTATE BATTERY C FOR BURNS TO MAINTAIN BALANCED BATTERIES	
			TLC	B. NO-GO FOR LOI IF SUM OF TWO LOWEST ENTRY BATTERIES LESS THAN 45.8 AMP HRS.	
			LO	C. NO-GO FOR UNDOCK IF SUM OF TWO LOWEST ENTRY BATTERIES LESS THAN 42.8 AMP HRS.	
		RULE NUMBERS 12-43 THROUGH 12-49 ARE RESERVED.			

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	12-50	MAIN BUS TIE MOTOR SWITCH FAILURES			
		A. ONE MOTOR SWITCH FAILS OPEN	LAUNCH	A.1. CONTINUE MISSION (A) IF MOTOR SW A/C TIE BAT C TO MAIN BUS A. (B) IF MOTOR SW B/C TIE BAT C TO MAIN BUS B.	
			ALL	2. CONTINUE MISSION CLOSE ALTERNATE MOTOR SW AND USE MAIN BUS TIE CB'S AS MOTOR SWITCHES.	A.2. BATTERIES MUST BE CHARGED THROUGH OPEN MOTOR SW. LEAVE BAT RLY CB CLOSED FOR CHARGING.
		B. ONE OR BOTH MOTOR SW FAILED CLOSED	ALL	B. CONTINUE MISSION USE CB'S AS MOTOR SWITCHES.	B. IF BOTH MOTOR SWITCHES FAIL CLOSED, BATTERIES CANNOT BE CHARGED.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	12-51	A. MAIN BUS A SHORTED GREATER THAN 25 AMPS	LAUNCH	A.1. CONTINUE MISSION (A) EDS AUTO/OFF - OFF (B) FC 2 TO MAIN B ONLY (C) BAT C TO MAIN B (D) INVERTER 3 TO AC 1, MAIN B (E) POWER DOWN MAIN A (F) TVC GIMBAL DRIVE. (P, Y) - 2 (G) GIMBAL MOTOR CB'S CONTROL (YAW 2, PITCH 2) BAT B - OPEN AFTER GIMBAL MOTOR TURN ON	
			PRE-PDI	A.2. ENTER NEXT BEST PTP - NO GO FOR PDI. RETAIN LM DESCENT STAGE FOR TEI.	
			POWERED DESCENT	A.3. CONTINUE MISSION NO GO FOR LUNAR STAY	
			ALL	A.4. ENTER NEXT BEST PTP. POWER DOWN MAIN A.	
		B. MAIN BUS B SHORTED GREATER THAN 25 AMPS	LAUNCH	B.1. CONTINUE MISSION (A) EDS AUTO/OFF - OFF (B) BAT C TO MAIN A (C) INVERTER 3 TO AC 2, MAIN A (D) POWER DOWN MAIN B	
			PRE-PDI	B.2. ENTER NEXT BEST PTP - NO GO FOR PDI. RETAIN LM DESCENT STAGE FOR TEI.	
			POWERED DESCENT	B.3. CONTINUE MISSION NO GO FOR LUNAR STAY	
			ALL	B.4. ENTER NEXT BEST PTP POWER DOWN MAIN B	
		C. MAIN BUS SHORTED GREATER THAN 25 AMPS AND FUEL CELL(S) CANNOT BE DISCONNECTED FROM SHORTED BUS.	LAUNCH	C.1. ABORT	C.1. FAILURE OF MOTOR SWITCH TO DISCONNECT FROM SHORTED BUS INDICATED BY FC SHORTED BUS T/B GRAY.
			PRE-PDI	C.2. ENTER NEXT BEST PTP IF MAIN BUS NOT RESTORED NO GO FOR PDI. RETAIN LM DESCENT STAGE FOR TEI.	
			POWERED DESCENT	C.3. CONTINUE MISSION NO GO FOR LUNAR STAY	
			ALL	C.4. ENTER NEXT BEST PTP	C.4. IF FUEL CELL FEED CIRCUITRY SHORTED, CLOSE FC REACTANT VALVES.

MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	12-52	A. BATTERY BUS SHORTED GREATER THAN 5 AMPS	LAUNCH	A.1. CONTINUE MISSION (A) PLACE EDS AUTO/OFF TO OFF. (B) OPEN ASSOCIATED MAIN BUS TO BAT BUS CB. (C) TIE BAT C TO ASSOCIATED MAIN BUS.	A.1. GREATER THAN 18 AMPS WILL CAUSE BATTERY BUS VOLTAGE TO BE LESS THAN OR EQUAL TO MAIN BUS VOLTAGE.
			PRE-PDI	2. ENTER NEXT BEST PTP-NO GO FOR PDI RETAIN LM DESCENT STAGE FOR TEI	
			POWERED DESCENT	3. CONTINUE MISSION-NO GO FOR LUNAR STAY	
			ALL	4. ENTER NEXT BEST PTP IF BUS NOT RESTORED	A.4. REMOVE POWER FROM BUS. IF SHORTED LESS THAN OR EQUAL TO 10 AMPS. POWER BUS JUST PRIOR TO ENTRY TO MAINTAIN SECS REDUNDANCY.
		B. BATTERY BUS SHORTED LESS THAN 5 AMPS	ALL	B. CONTINUE MISSION REMOVE POWER FROM BUS EXCEPT FOR MANEUVERS AND ENTRY	
	12-53	BATTERY RELAY BUS SHORTED			
		A SHORT GREATER THAN 2.0 AMPS	LAUNCH	A.1. CONTINUE MISSION	
			POWERED DESCENT	2. CONTINUE MISSION. NO GO FOR LUNAR STAY	
			ALL	3. ENTER NEXT BEST PTP OPEN BATTERY BUS TO BATTERY RELAY BUS CB'S.	
		B. SHORT LESS THAN 2.0 AMPS	ALL	B. CONTINUE MISSION	B. CHARGE BAT B CONTINOUSLY WITH BAT B POWER ENTRY AND POST LANDING CB OPEN. CONSIDER BATTERY CHARGER LOST FOR MISSION PLANNING.

MISSION RULES

SECTION 12 - CSM ELECTRICAL POWER SYSTEM

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	12-54	A. LOSS OF BATT RELAY BUS OR ONE BATTERY BUS, (UNABLE TO POWER BUS)	LAUNCH	A.1. CONTINUE MISSION	
			PRE-PDI	2. ENTER NEXT BEST PTP-NO GO FOR PDI. RETAIN LM DESCENT STAGE FOR TEI.	
			POWERED DESCENT	3. CONTINUE MISSION-NO GO FOR LUNAR STAY	
			ALL	4. ENTER NEXT BEST PTP	
		B. LOSS OF ONE MAIN BUS (UNABLE TO POWER BUS	LAUNCH	B.1. CONTINUE MISSION	
			PRE-PDI	2. ENTER NEXT BEST PTP. NO GO FOR PDI. RETAIN LM DESCENT STAGE FOR TEI.	
			POWERED DESCENT	3. CONTINUE MISSION NO GO FOR LUNAR STAY	
			ALL	4. ENTER NEXT BEST PTP. RETAIN LM	
	12-55	LOSS OF AUX BATT	POST DOCK	TBD	
			ALL	CONTINUE MISSION	
		RULE NUMBERS 12-56 THROUGH 12-59 ARE RESERVED.			

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	12-60	LOSS OF TWO INVERTERS	LAUNCH	A. CONTINUE MISSION	PLACE REMAINING INVERTER ON BOTH AC BUSES.
			PRE-PDI	B. ENTER NEXT BEST PTP- NO GO FOR PDI. RETAIN LM DESCENT STAGE FOR TEI	
			POWERED DESCENT	C. CONTINUE MISSION- NO GO FOR LUNAR STAY	
			ALL	D. ENTER NEXT BEST PTP RETAIN LM	
	12-61	LOSS OF ONE AC BUS (TWO PHASES CANNOT BE MAINTAINED GREATER THAN 95 VAC)	LAUNCH	A. CONTINUE MISSION	
			PRE-PDI	B. ENTER NEXT BEST PTP- NO GO FOR PDI. RETAIN LM DESCENT STAGE FOR TEI	
			POWERED DESCENT	C. CONTINUE MISSION- NO GO FOR LUNAR STAY	
			ALL	D. ENTER NEXT BEST PTP RETAIN LM	
	12-62	LOSS OF BOTH AC BUSES	LAUNCH	A. ABORT MODE I OR MODE II	
				1. OPEN DIRECT O2 FOR SUIT VENTILATION.	
				2. IF AFTER MODE II, ENTER PTP 2-1.	A.2. INITIATE CONTINUOUS FC H2 PURGE FOR COOLING.
			POWERED DESCENT	B. CONTINUE MISSION-	
			ALL	C. ENTER NEXT BEST PTP OR ATP. RETAIN LM IF SUITED, REMOVE HELMET AND GLOVES. IF TIME PERMITS, REMOVE SUITS. IF CABIN DEPRESSURIZED, USE DIRECT O2 UNTIL CABIN IS REPRESSURIZED.	2. FOR CSM ONLY, ENTER WITHIN 1-1/2 HOURS. INITIATE CONTINUOUS FC H2 PURGE FOR COOLING.
		RULE NUMBERS 12-63 THROUGH 12-69 ARE RESERVED.			

R -- ITEM ------

INSTRUMENTATION REQUIREMENTS

12-70 MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
AC BUS 1 PHASE A VAC	CC0200V	METER	SEPARATE	HIGHLY DESIRABLE	
AC BUS 1 PHASE B VAC	-------	METER	----------	HIGHLY DESIRABLE	12-5,6,61
AC BUS 1 PHASE C VAC	-------	METER	----------	HIGHLY DESIRABLE	
		COMMON METER			
AC BUS 2 PHASE A VAC	CC0203V	METER	SEPARATE	HIGHLY DESIRABLE	
AC BUS 2 PHASE B VAC	-------	METER	----------	HIGHLY DESIRABLE	12-5,6,61
AC BUS 2 PHASE C VAC	-------	METER	----------	HIGHLY DESIRABLE	
MAIN BUS A VDC	CC0206V	METER	SEPARATE	1 OF 2 MANDATORY	12-32,52,20C
MAIN BUS B VDC	CC0207V	METER	SEPARATE		12-22
BAT BUS A VDC	CC0210V	METER	SEPARATE	HIGHLY DESIRABLE	
BAT BUS B VDC	CC0211V	METER	SEPARATE	HIGHLY DESIRABLE	
BAT RELAY BUS VDC	CC0232V	METER	SEPARATE	HIGHLY DESIRABLE	
BAT A CURRENT	CC0222C	METER	COMMON		
BAT B CURRENT	CC0223C	METER	COMMON	2 OF 3 MANDATORY	12-4,33,40,41
BAT C CURRENT	CC0224C	METER	COMMON		
FC 1 CURRENT	SC2113C	METER	COMMON		
FC 1 O2 FLO	SC2141R	METER	COMMON	1 OF 3 MANDATORY	12-7,31,32,33,
FC 1 H2 FLO	SC2139R	METER	COMMON		22A
FC 2 CURRENT*	SC2114C	METER	COMMON		
FC 2 O2 FLO	SC2142R	METER	COMMON	1 OF 3 MANDATORY	12-7,31,32,33,
FC 2 H2 FLO	SC2140R	METER	COMMON		22A
FC 3 CURRENT	SC2115C	METER	COMMON		
FC 3 O2 FLO	SC2144R	METER	COMMON	1 OF 3 MANDATORY	12-7,31,32,33,
FC 3 H2 FLO	SC2141R	METER	COMMON		22A
BAT CHARGER CURRENT	SC0215C	METER	COMMON	HIGHLY DESIRABLE	
FC 1 SKIN TEMP	SC2084T	METER	COMMON	HIGHLY DESIRABLE	
FC 2 SKIN TEMP	SC2085T	METER	COMMON	HIGHLY DESIRABLE	12-22B
FC 3 SKIN TEMP	SC2086T	METER	COMMON	HIGHLY DESIRABLE	
FC 1 COND TEMP	SC2081T	METER	COMMON	HIGHLY DESIRABLE	
FC 2 COND TEMP	SC2082T	METER	COMMON	HIGHLY DESIRABLE	12-22B
FC 3 COND TEMP	SC2083T	METER	COMMON	HIGHLY DESIRABLE	
FC 1 RAD OUT TEMP	SC2087T	METER	COMMON	HIGHLY DESIRABLE	
FC 2 RAD OUT TEMP	SC2088T	METER	COMMON	HIGHLY DESIRABLE	12-22I
FC 3 RAD OUT TEMP	SC2089T	METER	COMMON	HIGHLY DESIRABLE	
BAT MANIFOLD PRESS	-------	METER	------	HIGHLY DESIRABLE	-------
INV 1 TEMP	CC0175T	MCWS	COMMON	HIGHLY DESIRABLE	-------
INV 2 TEMP	CC0176T	MCWS	COMMON	HIGHLY DESIRABLE	-------
INV 3 TEMP	CC0177T	MCWS	COMMON	HIGHLY DESIRABLE	-------
FC 1 PH	SC2160X	TALKBACK	COMMON	HIGHLY DESIRABLE	
FC 2 PH	SC2161X	TALKBACK	COMMON	HIGHLY DESIRABLE	12-22E
FC 3 PH	SC2162X	TALKBACK	COMMON	HIGHLY DESIRABLE	
AUX BATT (SM BATT)	SC0230V	------	------	HIGHLY DESIRABLE	

NOTE--- USE BAT C IN LIEU OF BATTERY WITH LOST INST

* COMMON SHUNT FOR FC 2 AND AUX BATT CURRENT

13 DOCKING AND UMBILICAL

R	ITEM	
		' GENERAL '
	13-1	THREE GOOD DOCKING RING LATCHES 120 DEG. APART ARE REQUIRED FOR AN IVT.
	13-2	DOCKED SPS OR DPS BURNS REQUIRE AT LEAST NINE GOOD DOCKING RING LATCHES.
	13-3	MANNED UNDOCKING OPERATIONS WILL BE TERMINATED FOR ANY FAILURE OF A DOCKING RING LATCH TO RELEASE. NO ATTEMPT WILL BE MADE TO DISASSEMBLE A DOCKING RING LATCH.
	13-4	WITH FAILURE OF THE CSM FOWARD HATCH PRIMARY LOCK/UNLOCKED MECHANISM, THE NOMINAL MISSION WILL BE PERFORMED USING THE SECONDARY LOCK/UNLOCK MECHANISM.
	13-5	LOSS OF VISUAL DOCKING AIDS (COAS AND TARGETS) WILL NOT INHIBIT DOCKING AND UNDOCKING.
	13-6	IF THE DOCKING PROBE FAILS TO INDICATE EXTENSION OR IF BOTH TALK BACK INDICATORS* ARE BARBER POLE, TD&E WILL BE ATTEMPTED.
		*NOTE---THE ONLY DOCKING PROBE INSTRUMENTATION CONSISTS OF TWO TALK BACK INDICATORS IN THE CSM.
		RULE NUMBERS 13-7 THROUGH 13-10 ARE RESERVED

R	ITEM	
		' MANAGEMENT '
	13-11	FOR MISFIRE OF A DOCKING RETRACT SQUIB, THE REMAINING SQUIB IN THE SAME SYSTEM WILL BE USED TO ATTEMPT COMPLETION OF DOCKING. TWO NITROGEN BOTTLES REMAINING ARE NORMALLY REQUIRED TO ALLOW UNDOCKING--HOWEVER, BASED ON THE FAILURE MODE, CONSIDERATION WILL BE GIVEN TO UNDOCKING WITH ONE NITROGEN BOTTLE REMAINING IN AN OPERABLE SYSTEM.
	13-12	THE CM FORWARD AND LM UPPER HATCH NORMALLY WILL BE INSTALLED FOR ANY TYPE OF MANEUVER OR DOCKING.
	13-13	DURING OPERATIONS WHEN CM/LM DOCKED STATUS IS MAINTAINED BY PROBE PRELOAD ONLY (DOCKING LATCHES COCKED) CM/LM THRUSTER ACTIVITY ABOUT CM/LM X-AXIS IS LIMITED AS FOLLOWS---

TUNNEL PRESSURE PSIA	COMBINED CM/LM ACTIVE THRUSTERS
GREATER THAN 1.5 PSIA	INHIBIT ALL CSM ROLL AND LM YAW CONTROL
BETWEEN 0 AND 1.5 PSIA	NO MORE THAN 2 JETTS
0 PSIA	NO MORE THAN 4 JETTS

	13-14	LOW PROBE TEMPERATURE WILL NOT INHIBIT DOCKING ATTEMPTS.				
		RULE NUMBERS 13-15 THROUGH 13-19 ARE RESERVED.				

MISSION RULES

SECTION 13 - DOCKING AND UMBILICAL

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC MISSION RULES	
	13-20	FAILURE TO ACHIEVE OR MAINTAIN POWER TO X-LUNAR BUS LOADS FROM CSM	DOCKED	CONTINUE MISSION - 1. INSURE LM DESCENT BATTERY LOW VOLTAGE TAPS - ON 2. OPEN LM EPS CB 11 & CB 16---DES ECA CIRCUIT BREAKERS WITHIN 6 HOURS OF THE TIME THE DESCENT BATTERIES WERE TURNED ON. 3. CLOSE EPS LM CB 11 & CB 16---DES ECA CIRCUIT BREAKERS AT FIRST PLANNED MANNING.	• NOMINAL MISSION MAY BE PERFORMED BECAUSE ECA THERMAL CONSTRAINTS WILL NOT BE VIOLATED WITH DESCENT ECA CIRCUIT BREAKERS OPEN. OVER CURRENT PROTECTION, HOWEVER, IS LOST UNTIL THESE CIRCUIT BREAKERS ARE CLOSED. EXTRA DESCENT AMP HOURS USED MAY AFFECT LUNAR STAY TIME.
	13-21	FAILURE TO ACHIEVE S-IVB/LM SEPARATION OR FAILURE TO MATE LM UMBILICALS (P23 AND P24)	TD&E	PERFORM CSM/LM FINAL SEP	S-IVB/LM SEP CANNOT BE ACHIEVED WITHOUT MATING AT LEAST ONE UMBILICAL. POWER CAN BE SWITCHED AND MAINTAINED WITH EITHER PLUG.
	13-22	FAILURE TO ACHIEVE CSM/LM FINAL SEPARATION	DOCKED	MUST PERFORM NORMAL UNDOCKING A. RETRIEVE PROBE AND DROGUE AND INSTALL. B. AFTER UNDOCKING, DEPRESS CSM AND JETTISON PROBE OVERBOARD.	
	13-23	FAILURE TO INDICATE DOCKING PROBE EXTEND OR BOTH TALK BACK INDICATORS ARE BARBER POLE.	TD&E UNDOCKED	A. CONTINUE MISSION ATTEMPT TD&E B. CONTINUE MISSION ATTEMPT DOCKING	DOCKING RING TUNNEL STRUCTURE DAMAGE MAY OCCUR TO THE EXTENT THAT TUNNEL PRESSURE CAN NOT BE MAINTAINED.
	13-24	CANNOT REMOVE CSM FORWARD HATCH	TD&E DOCKED	A. PERFORM CSM/LM FINAL SEP B. PERFORM CSM/LM FINAL SEP IF LM MANNED, PERFORM EVT TO CSM.	

MISSION RULES

SECTION 13 - DOCKING AND UMBILICAL

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	13-25	CANNOT REMOVE DOCKING PROBE, LM DROGUE, AND/OR LM UPPER HATCH.	DOCKED	CONTINUE MISSION PERFORM EVT IF LM MANNED	SPS AND SM RCS MANEUVERS MAY BE PERFORMED
	13-26	FAILURE TO RELEASE CAPTURE LATCHES	DOCKED	REDOCK	
	13-27	PRIMARY FORWARD HATCH LOCK/UNLOCK MECHANISM INOPERATIVE	ALL	CONTINUE MISSION	
	13-28	FAILURE TO LOCK CSM FORWARD HATCH	TD&E DOCKED	CONTINUE MISSION ENTER IN SUITS	REF SCP A15 I. A (ASSUMES HATCH CAN BE SEALED AND SECURED WITH CABIN PRESSURE)
	13-29	FAILURE TO REINSTALL PROBE AND/OR DROGUE OR FAILURE TO CLOSE LM UPPER HATCH	DOCKED	NO UNDOCKING	
	13-30	LOSS OF PRIMARY OR SECONDARY DOCKING SYSTEM	DOCKED	CONTINUE MISSION BASED ON FAILURE MODE, CONSIDERATION WILL BE GIVEN TO UNDOCKING WITH ONE GN2 BOTTLE REMAINING IN AN OPERABLE SYSTEM.	

R	ITEM	
		GENERAL
	14-1	LAUNCH THERE ARE NO SEQUENTIAL MALFUNCTIONS FOR WHICH LAUNCH WILL BE TERMINATED.
	14-2	IF AN ENTRY BATTERY IS LOST, THE EDS WILL BE FLOWN OPEN LOOP.
	14-3	ALL MISSION PHASES EXCEPT LUNAR ORBIT TO CONTINUE THE MISSION, BOTH PYRO BUSES AND BOTH LOGIC BUSES ARE REQUIRED.
	14-4	POWERED DESCENT THERE ARE NO CSM SEQUENTIAL SYSTEM FAILURES FOR WHICH POWERED DESCENT WILL BE TERMINATED
	14-5	SEQUENTIAL LOGIC BUS IS CONSIDERED FAILED IF--- A. VOLTAGE IS LESS THAN 22 VDC AND UNABLE TO ACTIVATE RCS ENABLE AND/OR SLA SEP RELAYS (CD0170X AND/OR CD0123X SYSTEM A, CD0171X AND/OR CD0124X SYSTEM B). B. LOGIC BUS SHORTED GREATER THAN 10 AMPS.
	14-6	PYRO BUS IS CONSIDERED FAILED IF--- A. SHORTED GREATER THAN 10 AMPS. B. FAILURE TO PERFORM ANY SEQUENTIAL FUNCTION WITH SUSPECTED FAILED PYRO SYSTEM.
		RULE NUMBERS 14-7 THROUGH 14-9 ARE RESERVED

R	ITEM	
		' MANAGEMENT '
	14-10	ARMING OF THE SEQUENTIAL SYSTEM WILL BE PERFORMED WHILE IN CONTACT WITH A GROUND TELEMETRY SITE. THE FLIGHT CREW WILL ARM THE LOGIC BUSES AND STAND BY FOR A GO FROM THE GROUND TO PROCEED WITH ARMING THE PYRO BUSES.
		RULE NUMBERS 14-11 THROUGH 14-19 ARE RESERVED

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC MISSION RULES	
	14-20	SEQUENTIAL LOGIC BUS A OR B LESS THAN OR EQUAL TO 22 VDC AND UNABLE TO ACTIVATE RCS ENABLE AND/OR SLA SEP RELAYS			CD0170X AND/OR CD0123X SYSTEM A, CD0171X AND/OR CD0124X SYSTEM B
			LAUNCH	A. CONTINUE MISSION ENTER 3-1 IF BUS NOT RESTORED	
			EO TLC	B. TERMINATE OPERATIONS ENTER NEXT BEST PTP IF BUS NOT RESTORED	
			LUNAR ORBIT/ LUNAR STAY	C. CONTINUE MISSION	
	14-21	PYRO BUS A OR B LESS THAN OR EQUAL TO 35 VDC			
		A. SHORTED GREATER THAN 10 AMPS	LAUNCH	A.1. CONTINUE MISSION	
			EO TLC	2. TERMINATE OPERATIONS ENTER NEXT BEST PTP	A.2. USE BATTERY TIE FOR PYRO POWER TO AFFECTED BUS
			LUNAR ORBIT/ LUNAR STAY	3. CONTINUE MISSION	B. USE BATTERY TIE FOR PYRO POWER TO AFFECTED BUS
		B. SHORTED LESS THAN 10 AMPS	ALL	B. CONTINUE MISSION	
		C. PYRO BUS TM READS 0 VDC AND PYRO BAT ONBOARD GREATER THAN 35 VDC	LAUNCH	C.1. CONTINUE MISSION	
			ALL	2. ATTEMPT FUNCTION USING SUSPECTED FAILED BUS ONLY--- (A) IF FUNCTION NORMAL, CONTINUE MISSION (B) IF FUNCTION DOES NOT WORK NORMALLY, ENTER NEXT BEST PTP	C.2. ASSUME PYRO BAT VERIFIED GREATER THAN 35 VDC PRIOR TO ARMING. IF ENTRY BAT USED IN LIEU OF PYRO BAT, VOLTAGE SHOULD BE APPROXIMATELY = TO BAT BUS VOLTAGE.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	14-22	TELEMETRY INDICATES AN EDS VOTE INPUT 1, 2, OR 3	LAUNCH	CONTINUE MISSION A. IF ANY ENTRY BATTERY LESS THAN 22 VDC, EDS AUTO/OFF SWITCH TO OFF B. ALL ENTRY BATTERIES GREATER THAN 22 VDC--- CHECK CORRESPONDING EDS CB'S 1, 2, OR 3 CLOSED	PARAMETERS ARE CD0132X, CD0133X, AND CD0134X RESPECTIVELY. A. BAT C VOLTAGE CAN ONLY BE MONITORED ONBOARD
	14-23	LET JETTISON MOTOR DOES NOT FIRE	LAUNCH	CONTINUE MISSION ATTEMPT JETTISON PER CREW CHECKLIST EMERGENCY PROCEDURE	
	14-24	SMJC ACTIVATES PREMATURELY	EO TLC	CONTINUE MISSION IF SOURCE OF ACTIVATION CAN BE DETERMINED AND ISOLATED. ENTER NEXT BEST PTP IF SOURCE OF ACTIVATION CAN NOT BE ISOLATED.	
			ALL	CONTINUE MISSION	
	14-25	ACTIVATED CM RCS PRESS LOGIC RELAYS.	ALL	CONTINUE MISSION A. PRIOR TO CM RCS PRESS---DO NOT ARM RESPECTIVE PYRO BUS (FOR BOTH INDICATIONS PERFORM SLA SEP WITH SECS ARM CB'S OPEN.) B. AT CM RCS PRESS---ARM RESPECTIVE PYRO BUS	CD0173X AND/OR CD0174X

MISSION RULES

SECTION 14 - CSM SEQUENTIAL

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	14-26	ACTIVATED SLA DEPLOY LOGIC RELAYS	ALL	CONTINUE MISSION A. PRIOR TO SLA SEP---DO NOT ARM RESPECTIVE PYRO BUS B. FOR SLA SEP---ARM RESPECTIVE PYRO BUS FIRST	CD0123X AND/OR CD0124X
	14-27	UNABLE TO PERFORM SLA SEPARATION	TLC	ENTER NEXT BEST PTP	
	14-28	LOST GROUND TO RESISTOR NETWORK FOR LOGIC OR PYRO BUS VOLTS MEASUREMENTS	LAUNCH EO TD+E	CONTINUE MISSION ARM BOTH SYSTEMS	ARMING AFFECTED SYSTEM WILL RESULT IN LOSS OF FOLLOWING PCM MEASUREMENTS--- LOGIC A
			ALL	B. CONTINUE MISSION DO NOT ARM AFFECTED SYSTEM UNTIL SEQUENTIAL GO/NO GO PRIOR TO ENTRY UNLESS OTHER SYSTEM FAILS.	SC2142R FC 1 O2 FLOW SP0930P FU SM/ENG INTERFACE P LOGIC B SC2140R FC 2 H2 FLOW ST0832K ALPHA CT. RATE CHAN 3 PYRO A SC2143R FC 2 O2 FLOW PYRO B SC2139R FC 1 H2 FLOW ST0831K ALPHA CT. RATE CHAN 2
	14-29	ACTIVATED APEX JETTISON LOGIC RELAYS	LUNAR ORBIT LUNAR STAY	A. CONTINUE MISSION DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED	DETECTED AT SECS POWER UP (CD0230X AND CD023X)
			ALL	B. ENTER NEXT BEST PTP DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED.	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	14-30	ACTIVATED DROGUE CHUTE DEPLOY LOGIC RELAY	LUNAR ORBIT/ LUNAR STAY	A. CONTINUE MISSION DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED	MAY BE DETECTED AT ANY TIME (CE0001X AND/OR CE0002X)
			ALL	B. ENTER NEXT BEST PTP. DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED.	
	14-31	ACTIVATED PILOT CHUTE DEPLOY LOGIC RELAY	LUNAR ORBIT/ LUNAR STAY	A. CONTINUE MISSION DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED	DETECTED AT SECS POWER UP PRIOR TO ENTRY (CE0003X AND/OR CE0004X) WITH ELS BAT A(B) CB CLOSED
			ALL	B. ENTER NEXT BEST PTP DO NOT ARM PYRO BUSES UNTIL MALFUNCTION HAS BEEN ISOLATED	
		RULE NUMBERS 14-32 THROUGH 14-49 ARE RESERVED.			

INSTRUMENTATION REQUIREMENTS

R	ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RUL REFERENCE
	14-50	PYRO BUS A VOLTS	CD0005V	-----	------	1 OF	14-21
		PYRO BUS B VOLTS	CD0006V	-----	------	2 M	14-21
		SEQ LOGIC BUS A VOLTS	CD0200V	-----	------	HD	14-20
		SEQ LOGIC BUS B VOLTS	CD0201V	-----	------	HD	14-20
		APEX JET A	CD0230X	-----	------	HD	14-29
		APEX JET B	CD0231X	-----	------	HD	14-29
		DROGUE DEPLOY A	CE0001X	-----	------	HD	14-30
		DROGUE DEPLOY B	CE0002X	-----	------	HD	14-30
		PILOT CHUTE DEPLOY A	CE0003X	-----	------	HD	14-31
		PILOT CHUTE DEPLOY B	CE0004X	-----	------	HD	14-31
		SLA SEP RELAY A	CD0123X	-----	------	HD	14-26
		RCS/SCS ACTIVATE A	CD0170X	-----	------	HD	-----
		SLA SEP RELAY B	CD0124X	-----	------	HD	14-26
		RCS/SCS ACTIVATE B	CD0171X	-----	------	HD	-----
		CM RCS PRESS SIG A	CD0173X	-----	------	HD	14-25
		CM RCS PRESS SIG B	CD0174X	-----	------	HD	14-25
		CM-SM SEP RELAY A	CD0023X	-----	------	HD	-----
		CM-SM SEP RELAY B	CD0024X	-----	------	HD	-----
		CREW ABORT A	CD0130X	-----	------	HD	-----
		CREW ABORT B	CD0131X	-----	------	HD	-----
		EDS ABORT VOTE 1	CD0132X	-----	------	HD	14-22
		EDS ABORT VOTE 2	CD0133X	-----	------	HD	14-22
		EDS ABORT VOTE 3	CD0134X	-----	------	HD	14-22
		EDS ABORT A	CD0135X	-----	------	HD	-----
		EDS ABORT B	CD0136X	-----	------	HD	-----
		MAIN CHUTE DISC A	CE0321X	-----	------	HD	-----
		MAIN CHUTE DISC B	CE0322X	-----	------	HD	-----
		EDS ABORT REQ A	BS0080X	-----	------	HD	-----
		EDS ABORT REQ B	BS0081X	-----	------	HD	-----
		DOCKING PROBE TEMP	CS0220T	-----	------	HD	
		CSM-LM LOCK RING SEP RELAY A	CD1154X	-----	------	HD	13-22
		CSM-LM LOCK RING SEP RELAY B	CD1155X	-----	------	HD	13-22
		LM CURRENT	SC2962C	METER	COMMON	HD	-----

15 CSM GUIDANCE AND CONTROL

R	ITEM	
		GENERAL
	15-1	LAUNCH THERE ARE NO FAILURES OF THE CSM GUIDANCE AND CONTROL SYSTEM WHICH ARE CAUSE FOR ABORT.
	15-2	EARTH ORBIT PHASE A. IN ORDER TO CONTINUE THE MISSION PAST THE NEXT BEST PTP, THE GUIDANCE AND CONTROL SYSTEMS MUST PROVIDE SPS CRITICAL BURN CAPABILITY AND ONE BACKUP DEORBIT METHOD (SM OR HYBRID). THE FOLLOWING MINIMUM CAPABILITIES MUST BE AVAILABLE--- 1. ATTITUDE CONTROL---DIRECT RCS AND RATE DAMPING IN EACH AXIS. 2. TVC (CRITICAL BURNS)--- ONE TVC SERVO LOOP IN EACH AXIS AND ONE TVC CONTROL MODE (ACCEL CMD EXCLUDED). 3. BACKUP DEORBIT--- AS LONG AS ENOUGH PROPELLANT IS AVAILABLE FOR AN SM DEORBIT, THE G&C SYSTEMS MUST PROVIDE THAT CAPABILITY. IF SM DEORBIT IS NOT POSSIBLE DUE TO LACK OF PROPELLANT OR A SYSTEMS FAILURE, THE G&C SYSTEMS MUST PROVIDE CAPABILITY FOR A HYBRID DEORBIT. (A) SM DEORBIT REQUIREMENTS--- - TRANSLATION CAPABILITY - ONE OPERATIONAL FDAI - RATE DAMPING IN ALL THREE AXES DAP OR SCS (B) HYBRID DEORBIT REQUIREMENTS--- - ALL SM DEORBIT REQUIREMENTS (RATE DAMPING MUST BE SCS) - OPERATIONAL IMU, CMC, AND MAIN DSKY - TWO OPERATIONAL RHC'S B. IN ORDER TO PERFORM A NON-CRITICAL BURN AFTER THE STORAGE TANKS ARE EMPTY, THE G&C SYSTEMS MUST PROVIDE THE CAPABILITY TO EXECUTE AN ULLAGE MANEUVER BY EITHER CMC AUTO (RCS DAP), SCS AUTO, OR DIRECT ULLAGE. C. IN ORDER TO COMMIT TO THE TRANSLUNAR COAST PHASE, THE GUIDANCE AND CONTROL SYSTEMS MUST PROVIDE SPS NON-CRITICAL GUIDANCE AND CONTROL SYSTEMS BURN CAPABILITY. THE FOLLOWING MINIMUM CAPABILITIES MUST ALSO BE AVAILABLE TO BE GO FOR TLI--- 1. ATTITUDE CONTROL---DIRECT RCS AND RATE DAMPING IN EACH AXIS. 2. TVC---TWO SERVO LOOPS AND BOTH G&N AND ONE SCS TVC CONTROL MODES (ACCEL CMD EXCLUDED). 3. G&N---CMC, IMU, AND MDC DSKY FULLY OPERATIONAL AND OPTICS CAPABLE OF ALIGNING PLATFORM. 4. DISPLAYS---ONE OPERATIONAL FDAI. 5. ATTITUDE REFERENCE---REDUNDANT ATTITUDE SOURCES ARE REQUIRED FOR ENTRY.
	15-3	TRANSLUNAR COAST IN ORDER TO CONTINUE THE MISSION PAST THE NEXT BEST PTP, THE GUIDANCE AND CONTROL SYSTEMS MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES--- A. ATTITUDE CONTROL---DIRECT RCS AND RATE DAMPING IN EACH AXIS. B. RCS TRANSLATION---X-AXIS VIA AUTO COILS OR DIRECT ULLAGE PUSHBUTTON.

R	ITEM	
	15-4	LOI, LUNAR ORBIT A. LOI WILL BE INHIBITED OR LUNAR ORBIT TERMINATED EARLY IF EITHER REDUNDANT ATTITUDE CONTROL, REDUNDANT SPS CONTROL OR NON-CRITICAL SPS CAPABILITY IS LOST. IN ADDITION, THE FOLLOWING MINIMUM CAPABILITIES MUST BE AVAILABLE BEFORE COMMITTING TO OR CONTINUING LUNAR ORBIT. 1. ATTITUDE CONTROL---DIRECT RCS AND RATE DAMPING IN EACH AXIS. 2. TVC---BOTH SERVO LOOPS AND TWO TVC CONTROL MODES (ACCEL CMD EXCLUDED). 3. G&N---THE G&N MUST BE FULLY OPERATIONAL WITH THE EXCEPTION OF OPTICS AND ONE DSKY. 4. RCS TRANSLATION---X-AXIS VIA AUTO COILS OR DIRECT ULLAGE PUSHBUTTON. B. IN ORDER TO PERFORM A NON-CRITICAL BURN THE G&C SYSTEMS MUST PROVIDE THE CAPABILITY TO EXECUTE AN ULLAGE MANEUVER BY EITHER CMC AUTO (RCS DAP), SCS AUTO, OR DIRECT ULLAGE.
	15-5	UNDOCKED THE UNDOCKED PHASE WILL BE DELETED OR TERMINATED IF THE G&C SYSTEMS CANNOT PROVIDE REDOCKING OR LM RESCUE CAPABILITY. THE G&C SYSTEMS MUST PROVIDE DIRECT RCS, RATE DAMPING AND TRANSLATION CAPABILITY IN EACH AXIS FOR LINE OF SIGHT CONTROL. IN ADDITION, THE FOLLOWING MINIMUM CAPABILITIES FOR LM RESCUE MUST BE AVAILABLE--- - OPERATIONAL OPTICS OR VHF SUBSYSTEM - ONE DSKY - TRANSLATION CAPABILITY IN EACH AXIS - RATE DAMPING IN ALL THREE AXES - OPERATIONAL IMU AND CMC - ONE OPERATIONAL RHC - ONE OPERATIONAL FDAI - DIRECT RCS - NON CRITICAL SPS BURN CAPABILITY

R	ITEM	
	15-6	ASCENT, DESCENT---THERE ARE NO GUIDANCE AND CONTROL SYSTEM FAILURES THAT AFFECT THE ASCENT OR DESCENT PHASES.
	15-7	LUNAR STAY PHASE LUNAR STAY WILL BE TERMINATED EARLY IF REDUNDANT SPS CONTROL CAPABILITY IS LOST. IN ADDITION, THE FOLLOWING MINIMUM CONTROL CAPABILITIES MUST BE AVAILABLE FOR THE ACCOMPLISHMENT OF TEI. 1. ATTITUDE CONTROL - DIRECT RCS IN TWO AXES AND RATE DAMPING IN TWO AXES. 2. TVC - BOTH SERVO LOOPS AND TWO TVC CONTROL MODES (ACCEL CMD EXCLUDED). 3. G&N - THE G&N MUST BE FULLY OPERATIONAL WITH THE EXCEPTION OF OPTICS AND NAV DSKY.
		RULES 15-8 AND 15-9 ARE RESERVED.

R	ITEM	
		' SYSTEMS MANAGEMENT '
	15-10	ATTITUDE CONTROL---CSM IN ACTIVE RCS CONTROL- LM WILL NOT BE IN ACTIVE ATTITUDE HOLD. LM IN ACTIVE RCS CONTROL- CSM WILL NOT BE IN ACTIVE ATTITUDE HOLD. FOR DOCKING ACTIVITIES AFTER OPENING THE APS INTERCONNECT (BOTH VEHICLES IN ACTIVE RCS CONTROL), THE CSM MUST BE IN A TIGHTER DEADBAND THAN THE LM.
	15-11	PIPA BIAS WILL BE UPDATED WHEN ACTUAL BIAS DIFFERS FROM THE VALUE IN CMC ERASABLE BY +/-.003 FT/SEC2. THE FAILURE LIMIT ON THE CSM ACCELEROMETER IS +/-.164 FT/SEC2. THE FIRST GYRO BIAS DRIFT WILL BE UPDATED IF THE DRIFT IS +/- 1 MERU (.015 DEG/HR). THEREAFTER, +/- 3 MERU (+/- .045 DEG/HR) WILL BE THE UPDATE CRITERIA. THE FAILURE LIMIT ON THE CSM GYRO IS +/- 100 MERU (+/- 1.5 DEG/HR).
	15-12	DELTA V COUNTER DRIFT SHOULD THE DELTA V COUNTER DRIFT BE GREATER THAN 0.01 FT/SEC2, THE VC SETTING WILL BE APPROPRIATELY BIASED. SHOULD THE DRIFT BE GREATER THAN 0.1 FT/SEC2, THE EMS WILL BE CONSIDERED FAILED.
	15-13	DAP INITIALIZATION GIMBAL TRIMS---WILL BE UPDATED FOR EVERY SPS MANEUVER BASED ON FINAL TRIM POSITIONS OF THE PREVIOUS MANEUVER AS MONITORED ON TELEMETRY. IF THE PREVIOUS MANEUVER WAS SCS CONTROLLED. IF THE PREVIOUS MANEUVER WAS G&N CONTROLLED, THE CMC STORED VALUES WILL BE USED. TRIMS WILL BE REINITIALIZED FROM THE GROUND AFTER EACH VEHICLE CONFIGURATION CHANGE AND AFTER EACH WEIGHT UPDATE. TRIMS MUST BE UPDATED WHEN GROUND COMPUTED VALUES DIFFER FROM CMC STORED VALUES BY 0.5 DEGREE. CSM, LM WEIGHT--- WILL BE UPDATED WHEN GROUND COMPUTED VALUES DIFFER FROM CMC STORED VALUES BY 1.0 PERCENT. WEIGHTS MUST BE UPDATED WHEN GROUND VALUES DIFFER FROM CMC VALUES BY 10.0 PERCENT.
		RULE NUMBERS 15-14 THROUGH 15-19 RESERVED.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC MISSION RULES	
	15-20	LOSS OF EITHER BMAG 1 OR 2 IN EITHER PITCH OR YAW CHANNEL	ALL	CONTINUE MISSION	A. REF MALF PROC--- G&C-1,3,4+8 SCS-1,3,3A,+6 B. NO SCS AUTO TVC C. IF IN YAW CHANNEL, AFTER .05G, RSI IS USABLE IF REMAINING GYRO IS SELECTED FOR RATE. RSI MUST BE REALIGNED IN ADDITION TO THE ABOVE, FOR YAW FAILURE AFTER .05G.
	15-21	LOSS OF BOTH BMAG 1 AND 2 IN EITHER PITCH OR YAW CHANNEL	LAUNCH	A. CONTINUE MISSION	A. MTVC ACCEL CMD IS ONLY MODE III OR MODE IV SPS CONTROL MODE.
			TLC	B. NO-GO FOR LOI	
			DESCENT	C. CONTINUE MISSION	
			ALL OTHERS	D. TERMINATE PHASE AND ENTER NEXT BEST PTP	D.1. IN LUNAR ORBIT DO DPS TEI. 2. IN EARTH ORBIT, LOSS OF PITCH CHANNEL RESULTS IN ALL THREE DEORBIT METHODS BEING SUBJECTED TO SINGLE FAILURES IN THE G&N SYSTEM. THE YAW LOSS PRECLUDES HYBRID DEORBIT AND SUBJECTS BOTH REMAINING DEORBIT METHODS TO SINGLE FAILURES IN THE G&N SYSTEM
			ENTRY	E. CONTINUE MISSION	E. RSI AND SCS FDAI ROLL UNUSABLE WITH YAW CHANNEL FAILURES.
	15-22	LOSS OF ROLL BMAG			
		A. NUMBER ONE	ALL	A. CONTINUE MISSION	A.1. MANUAL ROLL ATTITUDE CONTROL REQUIRED IN ALL SCS MODES. 2. NO SCS FDAI ROLL. RSI VALID.
		B. NUMBER TWO	ALL	B. CONTINUE MISSION	B.1. USE OF ATT 1/RATE 2 AND LIM CYCLE MAY PROVIDE RATE DAMPED ATTITUDE HOLD WHEN RCS DAP IS NOT USED. GYRO PACKAGE 2 MUST BE POWERED DOWN TO EFFECT ATTITUDE HOLD IF FAILURE IS HARDOVER. 2. SELECTION OF RATE 1 WILL PROVIDE BOTH RSI AND SCS FDAI ROLL FOR ENTRY. RSI MUST BE REALIGNED FOR ROLL FAILURE AFTER .05G.

MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	15-23	LOSS OF BOTH ROLL BMAG'S	LAUNCH	A. CONTINUE MISSION	
			EO	B.1. NO GO FOR TLI	
				2. ENTER NEXT BEST PTP IF SM DEORBIT NOT AVAILABLE	
			TLC	C. NO-GO FOR LOI	C. NO SCS FDAI ROLL OR RSI AVAILABLE FOR ENTRY.
			ALL OTHERS	D. CONTINUE MISSION	
	15-24	LOSS OF EITHER TVC SERVO LOOP IN EITHER PITCH OR YAW AXIS			- MAINTAIN 20 LBS/QUAD/AXIS FOR HARDOVER RECOVERY FOR UNDOCKED AND --- LBS/QUAD/ AXIS FOR HARDOVER RECOVERY FOR DOCKED SPS MANEUVERS.
			LAUNCH/ EO	A. CONTINUE ALTERNATE EO MISSION SELECT 1 OR 2 ON TVC GIMBAL DRIVE SWITCH IN APPROPRIATE AXIS	
			TLC	B. NO-GO FOR LOI	
			DESCENT	C. CONTINUE MISSION	
			ALL OTHERS	D. TERMINATE PHASE AND ENTER NEXT BEST PTP	D. IN LUNAR ORBIT DO DPS TEI.
	15-25	LOSS OF BOTH TVC SERVO LOOPS	LAUNCH	A. CONTINUE MISSION	A.1. REF MALF PROC G&C-1, G&N-4, SCS-A1
					2. NO MODE III OR IV CAPABILITY. LIMITED LANDING POINT CONTROL IN MODE III OR IV WITH SM-RCS.
			EO	B. ENTER NEXT BEST PTP	
				RCS DEORBIT	
			TLC	C. NO-GO FOR LOI	
			DESCENT	D. CONTINUE MISSION	
			ALL OTHERS	E. TERMINATE PHASE AND ENTER NEXT BEST PTP	E. IN LUNAR ORBIT DO DPS TEI.
	15-26	LOSS OF PROPORTIONAL CONTROL FROM---			
		A. EITHER RHC	ALL	A. CONTINUE MISSION USE REMAINING RHC	
		B. BOTH RHC'S	ALL	B. CONTINUE MISSION USE DIRECT RCS OR ACCEL CMD FOR MANUAL MANEUVERS	B. NO MTVC RATE OR MTVC ACCEL CMD CAPABILITY

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	15-27	LOSS OF DIRECT RCS CONTROL FROM---			• REF MALF PROC SCS 5
		A. EITHER RHC, ANY OR ALL AXES	ALL	A. CONTINUE MISSION	
		B. BOTH RHC'S, SAME AXIS	LAUNCH	B.1. CONTINUE MISSION	
			DESCENT	2. CONTINUE MISSION	
			LUNAR STAY	3. CONTINUE MISSION	
			ALL OTHERS	4. TERMINATE PHASE AND ENTER NEXT BEST PTP	B.4. FAILURE VIOLATES DIRECT RCS REQUIREMENT.
		C. BOTH RHC'S, TWO AXES	LUNAR STAY	C. TERMINATE PHASE AND ENTER NEXT BEST PTP.	
	15-28	COMPLETE LOSS OF AUTO ATTITUDE CONTROL IN PITCH AND YAW CHANNELS.			• REF MALF PROC SCS 1 SUSPECTED FAILURE WOULD BE AUTO INHIBIT CIRCUITRY.
		A. CONTROL IS REGAINED BY OPENING EMS CB'S	ALL	A. CONTINUE MISSION AFTER SM JETTISON EMS MAY BE REENABLED WITHOUT LOSS OF AUTO RCS	
		B. CONTROL IS REGAINED BY PLACING S/C CONTROL SWITCH TO CMC.	ALL	B. CONTINUE MISSION	B. NO SCS ATTITUDE CONTROL
		C. CONTROL IS NOT REGAINED	DESCENT	C.1. CONTINUE MISSION	
			ALL OTHERS	2. TERMINATE PHASE AND ENTER NEXT BEST PTP USE DIRECT ULLAGE AND DIRECT RCS.	C.2. FAILURE VIOLATES RATE DAMPING REQUIREMENTS.
	15-29	LOSS OF FLIGHT DIRECTOR ATTITUDE INDICATORS			• REF MALF PROC G&C-1,2,3,4,5+6
		A. ONE	ALL	A. CONTINUE MISSION	
		B. BOTH	LAUNCH	B.1. CONTINUE MISSION	
			TLC	2. NO-GO FOR LOI	
			DESCENT	3. CONTINUE MISSION	
			LUNAR STAY	4. CONTINUE MISSION	
			ALL OTHERS	5. TERMINATE PHASE AND ENTER NEXT BEST PTP	5. IN LUNAR ORBIT, DO DPS TEI.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	15-30	LOSS OF AC1 PHASE A			- LOSS OF AC1 PHASE A RESULTS IN THE LOSS OF--- A. REDUNDANT SERVO LOOP POWER. BOTH SERVO LOOPS MUST BE POWERED BY THE SAME BUS. B. PROPORTIONAL ATTITUDE CONTROL FROM BOTH RHC'S. ALL PROPORTIONAL CONTROL FROM RHC NO. 1. C. FDAI NO. 1 D. GYRO ASSEMBLY NO. 1 E. SCS TOTAL ATTITUDE ERROR F. SCS TOTAL ATTITUDE G. SCS AUTO TVC CAPABILITY H. SCS MINIMUM IMPULSE CAPABILITY I. SCS ATTITUDE CONTROL RATE DAMPING J. GPI P&Y DRIVE NO. 1. . IN EARTH ORBIT, LOSS OF AC1 PRECLUDES HYBRID DEORBIT AND SUBJECTS BOTH REMAINING DEORBIT METHODS TO A SINGLE FAILURE (AC2 PHASE A)
			LAUNCH	A. CONTINUE MISSION	
			TLC	B. NO-GO FOR LOI	
			DESCENT	C. CONTINUE MISSION	
			ALL OTHERS	D. TERMINATE PHASE AND ENTER NEXT BEST PTP	D. IN LUNAR ORBIT DO DPS TEI.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	15-31	LOSS OF AC2 PHASE A			- LOSS OF AC2 PHASE A RESULTS IN THE LOSS OF--- A. REDUNDANT SERVO LOOP POWER B. ALL PROPORTIONAL CONTROL C. FDAI NO. 2 D. GYRO ASSEMBLY NO. 2 E. SCS PITCH AND YAW TOTAL ATTITUDE F. ALL SCS TVC CAPABILITY (AUTO, RATE AND ACCEL CMD) G. RSI H. GPI P&Y DRIVE NO. 2 • IN EARTH ORBIT, LOSS OF AC2 RESULTS IN ALL THREE DEORBIT METHODS BEING SUBJECTED TO A SINGLE FAILURE (AC1 PHASE A).
			LAUNCH	A. CONTINUE MISSION	
			TLC	B. NO-GO FOR LOI	
			DESCENT	C. CONTINUE MISSION	
			ALL OTHERS	D. TERMINATE PHASE AND ENTER NEXT BEST PTP	D. IN LUNAR ORBIT DO DPS TEI.
	15-32	LOSS OF ORBIT RATE DISPLAY (ORDEAL) EARTH AND LUNAR	ALL	CONTINUE MISSION	REF MALF PROC G&C-4+5
	15-33	LOSS OF ENTRY MONITOR SYSTEM	ALL	CONTINUE MISSION	REF MALF PROC EMS-1
	15-34	GROUND AT EITHER SPS SOL DRIVER OUTPUT AND UNABLE TO REMOVE	ALL	CONTINUE MISSION-OPEN SPS PILOT VALVE CB'S	• REF MALF PROC G&C-1

MISSION RULES

SECTION 15 - GUIDANCE AND CONTROL

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	15-35	LOSS OF TRANSLATION HAND CONTROLLER	LAUNCH	A. CONTINUE MISSION	
			EARTH ORBIT	B. ENTER NEXT BEST PTP	B. VIOLATES BOTH SM AND HYBRID DEORBIT MINIMUM REQUIREMENTS.
			TLC	C. CONTINUE MISSION	
			LO	D. NO-GO FOR UNDOCKING	VIOLATES LM RESCUE MINIMUM REQUIREMENTS.
			DOI	E. NO GO FOR DOI, CIRC AND PDI	
			UNDOCKED	F. DOCK	
			ALL OTHERS	G. CONTINUE MISSION	
		RULE NUMBERS 15-36 THROUGH 15-49 ARE RESERVED.			

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	15-50	LOSS OF COMMAND MODULE COMPUTER			• REF MALF PROC G&N-5
			LAUNCH	A. CONTINUE MISSION	
			EO	B. CONTINUE ALTERNATE EO MISSION IF BOTH SPS AND SM DEORBIT CAPABILITY AVAILABLE	B. VIOLATES HYBRID DEORBIT MINIMUM REQUIREMENTS
			TLC	C. NO-GO FOR LOI	
			LO	D. ENTER NEXT BEST PTP	
			UNDOCKED	E. DOCK	E. VIOLATES LM RESCUE MINIMUM REQUIREMENTS
			DESCENT	F. CONTINUE MISSION	
			POST DOCK	G. RETAIN LM ASCENT	G. USE LM FOR COMMB/U
			ENTRY	H. PERFORM BACKUP ENTRY	I. IN LUNAR ORBIT DO DPS TEI.
			ALL OTHERS	I. TERMINATE PHASE AND ENTER NEXT BEST PTP	
	15-51	LOSS OF DSKY			• REF MALF PROC G&C 5
		A. EITHER MDC OR LEB DSKY	ALL	A. CONTINUE MISSION	
		B. BOTH MDC AND LEB DSKY	EO	B.1. CONTINUE ALTERNATE EO MISSION IF BOTH SPS AND SM DEORBIT CAPABILITY AVAILABLE	B.1. VIOLATES HYBRID DEORBIT MINIMUM REQUIREMENTS
			TLC	2. NO-GO FOR LOI	
			LO	3. ENTER NEXT BEST PTP	
			UNDOCKED DESCENT	4. DOCK 5. CONTINUE MISSION	4. VIOLATES LM RESCUE MINIMUM REQUIREMENTS
			POST DOCK	6. RETAIN LM ASCENT	6. USE LM FOR COMMB/U
			ENTRY	7. PERFORM BACKUP ENTRY	8. IN LUNAR ORBIT DO DPS TEI.
			ALL OTHERS	8. TERMINATE PHASE AND ENTER NEXT BEST PTP	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	15-52	LOSS OF INERTIAL SUBSYSTEM			• REF MALF PROC G&N-6
			LAUNCH	A. CONTINUE MISSION	
			EO	B. CONTINUE ALTERNATE EO MISSION IF BOTH SPS AND SM DEORBIT CAPABILITY AVAILABLE	B. VIOLATES HYBRID DEORBIT MINIMUM REQUIREMENTS
			TLC LO	C. NO-GO FOR LOI D. ENTER NEXT BEST PTP	
			UNDOCKED	E. DOCK	E. VIOLATES LM RESCUE REQUIREMENTS
					G. USE LM G+N TO MONITOR BURNS
			DESCENT	F. CONTINUE MISSION	
			POST DOCK	G. RETAIN LM ASCENT	
			ENTRY	H. PERFORM BACKUP ENTRY	
			ALL OTHERS	I. TERMINATE PHASE AND ENTER NEXT BEST PTP	1.1. VIOLATES LM RESCUE MINIMUM REQUIREMENTS 2. IN LUNAR ORBIT DO DPS TEI
	15-53	LOSS OF OPTICS SUBSYSTEM			• REF MALF PROC G&N-5
			LAUNCH	A. CONTINUE MISSION	
			EO	B. CONTINUE ALTERNATE EO MISSION USE BACKUP ALIGNMENT PROCEDURE (COAS)	
			TLC	C. NO-GO FOR LOI	
			ALL OTHERS	CONTINUE MISSION	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	15-54	LOSS OF OPTICS SYBSYSTEM COUPLING DATA UNIT DIGITAL TO ANALOG CONVERTER			REF MALF PROC G&C-1 CONSTITUTES LOSS OF TVC DAP
			LAUNCH	A. CONTINUE MISSION	
			EO	B. CONTINUE ALTERNATE EO MISSION IF BOTH SPS AND SM DEORBIT CAPABILITY AVAILABLE	
			TLC	C. NO-GO FOR LOI	
			LO	D. ENTER NEXT BEST PTP	
			UNDOCKED	E. DOCK	
			DESCENT	F. CONTINUE MISSION	
			ALL OTHERS	G. TERMINATE PHASE AND NEXT BEST PTP	
		RULE NUMBERS 15-55 THROUGH 15-59 ARE RESERVED.			

INSTRUMENTATION REQUIREMENTS

R	ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
	15-60	CMC DIGITAL DATA	CG0001V	-	-	MANDATORY	15-50
		SPS SOL DRIVER 1	CH3604X	EMS-SPS-ON	SEPARATE	HIGHLY DESIRABLE	15-34
		SPS SOL DRIVER 2	CH3605X	EMS-SPS-ON	SEPARATE	HIGHLY DESIRABLE	15-34
		PITCH GIMBAL POS 1 & 2	CH3517H	GPI	COMMON	1 OF 2 MANDATORY -OB/HD-PCM	15-24/25
		YAW GIMBAL POS 1 & 2	CH3518H	GPI	COMMON	1 OF 2 MANDATORY -OB/HD-PCM	15-24/25
		TM BIAS 2.5 VDC	CG1110V	-	-	HIGHLY DESIRABLE	15-52/53/54
		PIPA TEMP	CG2300T	-	-	HIGHLY DESIRABLE	15-52
		IMU HTR +28 VDC	CH1513X	-	-	HIGHLY DESIRABLE	15-52
		CMC OPERATE +28 VDC	CG1523X	-	-	HIGHLY DESIRABLE	15-50
		OPTX OPERATE +28 VAC	CG1533X	-	-	HIGHLY DESIRABLE	15-54
		IG 1X RSVR OUT SIN	CG2112V	FDAI	COMMON	HIGHLY DESIRABLE	15-52
		IG 1X RSVR OUT COS	CG2113V	FDAI	COMMON	HIGHLY DESIRABLE	15-52
		MG 1X RSVR OUT SIN	CG2142V	FDAI	COMMON	HIGHLY DESIRABLE	15-52
		MG 1X RSVR OUT COS	CG2143V	FDAI	COMMON	HIGHLY DESIRABLE	15-52
		OG 1X RSVR OUT SIN	CG2172V	FDAI	COMMON	HIGHLY DESIRABLE	15-52
		OG 1X RSVR OUT COS	CG2173V	FDAI	COMMON	HIGHLY DESIRABLE	15-52
		SHAFT CDU DAC OUT	CG3721V	-	-	HIGHLY DESIRABLE	15-54
		TRUNNION CDU DAC OUT	CG3722V	-	-	HIGHLY DESIRABLE	15-54
		CMC WARNING	CG5040X	C&W	COMMON	HIGHLY DESIRABLE	15-50
		PITCH ATT ERROR	CH3500H	FDAI	COMMON	HIGHLY DESIRABLE	15-20/21/22/23
		YAW ATT ERROR	CH3501H	FDAI	COMMON	HIGHLY DESIRABLE	15-20/21/22/23
		ROLL ATT ERROR	CH3502H	FDAI	COMMON	HIGHLY DESIRABLE	15-20/21/22/23
		SCS PITCH BODY RATE	CH3503R	FDAI	COMMON	HIGHLY DESIRABLE	15-20/21/22/23
		SCS YAW BODY RATE	CH3504R	FDAI	COMMON	HIGHLY DESIRABLE	15-20/21/22/23
		SCS ROLL BODY RATE	CH3505R	FDAI	COMMON	HIGHLY DESIRABLE	15-20/21/22/23
		SCS TVC PITCH AUTO CMD	CH3582V	-	-	HIGHLY DESIRABLE	15-24/25
		SCS TVC YAW AUTO CMD	CH3583V	-	-	HIGHLY DESIRABLE	15-24/25
		MTVC PITCH CMD	CH3585H	-	-	HIGHLY DESIRABLE	15-24/25
		MTVC YAW CMD	CH3586H	-	-	HIGHLY DESIRABLE	15-24/25
		FDAI ERROR 5, RATE 5	CH3592X	-	-	HIGHLY DESIRABLE	15-20/21/22/23
		FDAI ERROR 50/15, RATE 50/10	CH3593X	-	-	HIGHLY DESIRABLE	15-20/21/22/23
		PITCH DIFF CLUTCH CUR	CH3666C	-	-	HIGHLY DESIRABLE	15-24/25
		YAW DIFF CLUTCH CUR	CH3667C	-	-	HIGHLY DESIRABLE	15-24/25

16 CSM SERVICE PROPULSION SYSTEM

R	ITEM	
		GENERAL
	16-1	A. CATEGORIES OF FAILURES--- FAILURES AFFECTING THE SPS FAIL INTO ONE OF THREE CATEGORIES--- 1. FAILURES WHICH CAUSE THE SPS TO BE UNSAFE-- THESE FAILURES RESULT IN MISSION TERMINATION ASAP. 2. FAILURES WHICH CAUSE THE SPS TO BE INOPERABLE OR HAZARDOUS TO OPERATE-- THESE FAILURES RESULT IN ALTERATION OF THE MISSION TO MINIMIZE USAGE OF THE SPS. 3. FAILURES SUCH THAT CONTINUED OPERATION WILL RESULT IN SUBSEQUENT DEGRADATION-- THESE FAILURES ALLOW PERFORMANCE OF CRITICAL BURNS ONLY. B. ULLAGE REQUIREMENTS--- SUBSEQUENT TO THE DEPLETION OF STORAGE TANK PROPELLANTS AN ULLAGE MANEUVER WILL NORMALLY BE PERFORMED PRIOR TO ANY BURN, HOWEVER, INABILITY TO PERFORM AN ULLAGE WILL NOT PRECLUDE A CRITICAL BURN. C. PREMATURE TERMINATION OF BURNS--- CRITICAL BURNS WILL NOT BE TERMINATED BECAUSE OF ANOMALIES. NON-CRITICAL BURNS WILL BE TERMINATED UNDER VARIOUS CONDITIONS AS SPECIFIED IN RULE 3-31 AND THE SPECIFIC RULES OF THIS SECTION.
	16-2	LAUNCH PHASE THERE ARE NO SPS FAILURES WHICH REQUIRE A LAUNCH ABORT.
	16-3	RESERVED

R	ITEM	
	16-4	EARTH ORBIT PHASE A. CRITICAL BURNS IN THIS PHASE ARE MODE IV, APOGEE KICK AND DEORBIT. IF THE SPS IS INCAPABLE OF PERFORMING CRITICAL BURNS, THE MISSION WILL BE TERMINATED BY ENTRY INTO THE NEXT BEST PTP USING SMRCS OR HYBRID TECHNIQUES. B. IF THE SPS IS INCAPABLE OF PERFORMING NON-CRITICAL BURNS, TLI WILL BE INHIBITED AND A SUITABLE EARTH ORBIT ALTERNATE MISSION WILL BE IMPLEMENTED. THE SPS MAY BE USED FOR DEORBIT ONLY. C. IN ORDER TO PROVIDE THE TOTAL CAPABILITY TO DEORBIT FROM ANY POINT IN THIS PHASE, THE LM DPS AND LM RCS MAY BE USED FOR ORBIT SHAPING.
	16-5	TRANSLUNAR COAST PHASE A. CRITICAL BURNS IN THIS PHASE ARE TIME CRITICAL ABORTS, BURNS TO ASSURE FREE RETURN OR BURNS TO AVOID LUNAR OR LAND IMPACT. HOWEVER, ONCE INITIATED WITH THE SPS, THESE BURNS ARE CONSIDERED NON-CRITICAL BECAUSE SUFFICIENT TIME IS AVAILABLE FOR ANALYSIS AND POSSIBLE CORRECTIVE ACTION. B. IF THE SPS IS INCAPABLE OF PERFORMING NON-CRITICAL MANEUVERS, FURTHER NON-CRITICAL BURNS AND LOI WILL BE INHIBITED. C. CERTAIN ABORT BURNS, BURNS TO ASSURE FREE RETURN OR BURNS TO AVOID LUNAR OR LAND IMPACT MAY USE THE LM DPS AND LM RCS.

R	ITEM	
	16-6	LUNAR ORBIT PHASE A. TEI IS THE ONLY CRITICAL BURN IN THIS PHASE. B. IF THE SPS IS INCAPABLE OF PERFORMING NON-CRITICAL BURNS, FURTHER NON-CRITICAL BURNS WILL BE INHIBITED. C. LM DPS MAY BE USED FOR TEI IF THE CAPABILITY EXISTS.
	16-7	DESCENT PHASE THE LM POWERED DESCENT WILL BE ABORTED FOR SPS PROPELLANT LEAKS.
	16-8	UNDOCKED AND LUNAR STAY PHASES A. THE LUNAR ORBIT PLANE CHANGE IS A CRITICAL BURN IF OUTSIDE TOTAL LM CAPABILITY. B. THESE PHASES WILL BE TERMINATED FOR CONFIRMED LOSS OF SPS REDUNDANCY. C. LUNAR STAY WILL BE ABORTED AT T1 ONLY FOR SPS PROPELLANT LEAKS.
	16-9	ASCENT PHASE LM RESCUE BURNS MAY BE REQUIRED, AND THEY ARE CRITICAL.
	16-10	TRANSEARTH COAST PHASE CRITICAL BURNS IN THIS PHASE ARE MIDCOURSE CORRECTIONS TO ATTAIN THE PROPER ENTRY CORRIDOR WHICH ARE OUTSIDE SM-RCS CAPABILITY. HOWEVER, ONCE INITIATED, THESE BURNS ARE CONSIDERED NON-CRITICAL BECAUSE SUFFICIENT TIME IS THEN AVAILABLE FOR ANALYSIS AND POSSIBLE CORRECTIVE ACTION.
	16-11	THERE ARE NO SPS FAILURES REQUIRING RETENTION OF THE LM ASCENT STAGE.

R	ITEM	
		' SYSTEMS MANAGEMENT '
	16-12	PROPELLANT GAGING A. FOR BURNS LESS THAN 25 SECONDS DURATION--- 1. PRIME METHOD----IMU DELTA V OBTAINED 2. BACKUP METHOD----FLOW RATE X BURNTIME B. FOR BURNS GREATER THAN 25 SECONDS DURATION--- 1. PRIME METHOD----IMU DELTA V OBTAINED 2. BACKUP METHOD----ONBOARD GAGING SYSTEM
	16-13	THE PU VALVE WILL BE USED TO MAINTAIN THE UNBALANCE READING--- A. PRIOR TO CROSSOVER---AT THE STABLE VALUE OCCURING APPROXIMATELY 25 SEC AFTER LOI IGNITION. B. AFTER CROSSOVER--- AT APPROXIMATELY ZERO UNBALANCE.
	16-14	DUAL BANK VS SINGLE BANK OPERATION THE SPS WILL ALWAYS BE STARTED USING A SINGLE BANK. HOWEVER, THE OTHER BANK WILL BE OPENED 2 TO 5 SECONDS AFTER IGNITION FOR BURNS PLANNED TO BE LONGER THAN 6 SECONDS. THE FIRST BURN WILL BE STARTED ON BANK A.
	16-15	PROPELLANT MANAGEMENT A. THE SPS PROPELLANT REDLINE PRE LOI TO PROVIDE CAPABILITY FOR LOI, TEI (NORMAL RETURN) AND TEMC (3 SIGMA SCS CUTOFF ON TEI) IS 91 PERCENT INDICATED PROPELLANT REMAINING. B. THE SPS PROPELLANT REDLINE PREUNDOCKING TO PROVIDE CAPABILITY FOR CIRC, LM RESCUE, LOPC 1, TEI (SLOW RETURN) AND TEMC (3 SIGMA SCS CUTOFF ON TEI) IS 31.5 PERCENT INDICATED PROPELLANT REMAINING.
	16-16	PROPELLANT FEEDLINE TEMPERATURE MANAGEMENT SPS LINE HEATERS WILL BE MANUALLY CYCLED TO MAINTAIN FEEDLINE TEMPERATURES BETWEEN 45 DEG. F AND 75 DEG. F. AND ENGINE VALVE TEMPERATURE ABOVE 45 DEG. F.
	16-17	ULLAGE MANAGEMENT IN GENERAL, SPS BURNS REQUIRING ULLAGE WILL BE PRECEDED BY A TWO JET ULLAGE.
		RULE NUMBERS 16-18 THROUGH 16-19 ARE RESERVED.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC MISSION RULES	
	16-20	SUSTAINED PRESSURE DECAY IN EITHER THE FUEL OR OXIDIZER TANK (COULD BE HELIUM OR FUEL OR OXIDIZER)			• MALF PROC--- SPS 1B
			LAUNCH	CONTINUE MISSION	• MANUAL PRESSURIZATION OF THE TANKS SHOULD BE CONSIDERED PRIOR TO ANY REQUIRED SPS BURN.
				PLAN RCS DEORBIT AT NEXT BEST PTP	
				IF LAND IMPACT IS IMMINENT AFTER ABORTING REPRESS MANUALLY AND PERFORM BURN TO AVOID LAND.	
			EO	ENTER NEXT BEST PTP RCS DEORBIT	
			TLC	NO-GO FOR LOI INHIBIT NON-CRITICAL SPS BURNS	
			LO	PLAN TEI ASAP/NO GO DOI USE LM DPS IF CAPABILITY EXISTS	
			UNDOCKED	DOCK ASAP	DO NOT STAGE LM
			DESCENT	ABORT	
			LUNAR STAY	RETURN TO CSM ASAP	
			TEC	CONTINUE MISSION INHIBIT NON-CRITICAL BURNS	
		A. DURING NON-CRITICAL BURN	ALL	A. TERMINATE BURN	
		B. DURING CRITICAL BURN	ALL	B. CONTINUE BURN	
	16-21	LOSS OF ONE GN2 TANK PRESSURE (LESS THAN 400 PSIA)	ALL	1. VERIFY OPERATION OF SUSPECTED TANK BY ACTIVATING IT AFTER STARTING ON GOOD BANK.	• MALF PROC--- SPS 9
				2. IF LOSS CONFIRMED BY ENGINE OPERATION REF MR 16-22.	• TRANSDUCER INDICATION CANNOT BE VERIFIED WITHOUT ENGINE OPERATION.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	16-22	LOSS OF ONE BANK OF BALL VALVES	LAUNCH/ EO	A. N/A	MALF PROC SPS-9
			TLC	B. NO-GO FOR LOI/DOI	
			LO	C. ENTER NEXT BEST PTP USE LM DPS IF AVAILABLE	
			UNDOCKED/ DESCENT LUNAR STAY	D. N/A	
				E. ENTER NEXT BEST PTP	
	16-23	LOSS OF BOTH GN2 TANK PRESSURES (LESS THAN 400 PSIA)	LAUNCH	A. CONTINUE MISSION	• MALF PROC--- SPS 9
			EO	B. ENTER NEXT BEST PTP RCS DEORBIT	• TRANSDUCER INDICATION CANNOT BE VERIFIED WITHOUT ENGINE OPERATION.
			TLC	C. NO-GO FOR LOI/DOI	
			LO	D. PLAN TEI ASAP WITH LM DPS	
			UNDOCKED	E. DOCK ASAP	E. DO NOT STAGE LM
			DESCENT	F. CONTINUE MISSION	
			LUNAR STAY	G. RETURN TO CSM ASAP	
			TEC	H. CONTINUE MISSION	
	16-24	FUEL FEEDLINE AND/OR OXIDIZER FEEDLINE TEMP LESS THAN 40 DEG F. AND UNABLE TO INCREASE.			• MALF PROC--- SPS 11 LIMITATION FOR CRITICAL BURNS IS 25 DEG F.
			LAUNCH	A. CONTINUE MISSION	
			EO	B. ENTER NEXT BEST PTP RCS DEORBIT	
			TLC	C. NO-GO FOR LOI/DOI	
			LO	D. PLAN TEI ASAP WITH LM DPS	
			UNDOCKED	E. DOCK ASAP	
			DESCENT	F. CONTINUE MISSION	F. DO NOT STAGE LM
			LUNAR STAY	G. RETURN TO CSM ASAP	
			TEC	H. CONTINUE MISSION	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	16-25	ENGINE FLANGE TEMP GOES HIGHER THAN 480 DEG F DURING AN SPS BURN.			
			LAUNCH	NOT APPLICABLE	
			EO	ENTER NEXT BEST PTP	
				RCS DEORBIT	
			TLC	NO GO FOR LOI/DOI/PDI	
			LO	ENTER NEXT BEST PTP, USE DPS IF AVAILABLE.	
		A. DURING NON-CRITICAL BURN	ALL	A. TERMINATE BURN INHIBIT FURTHER NON-CRITICAL BURNS	
		B. DURING CRITICAL BURN	ALL	B. CONTINUE BURN INHIBIT FURTHER NON-CRITICAL BURNS	
	16-26	THRUST CHAMBER PRESSURE LESS THAN 70 PSI CONFIRMED BY OTHER INSTRUMENTATION			• MALF PROC--- SPS 6
			LAUNCH	NOT APPLICABLE	• CONFIRMING INSTRUMENTATION INCLUDES ONBOARD PC METER, CREW, DEGRADED THRUST, FU AND OX INTERFACE PRESSURES, F/O VALVE POSITIONS, FU AND OX TANK PRESSURES.
			EO	ENTER NEXT BEST PTP - RCS DEORBIT	
			TLC	NO GO FOR LOI/DOI/PDI	
			LO	ENTER NEXT BEST PTP, USE LM DPS IF AVAILABLE	
		A. DURING NON-CRITICAL BURN		A. TERMINATE BURN INHIBIT FURTHER NON-CRITICAL BURNS	
		B. DURING CRITICAL BURN		B. CONTINUE BURN INHIBIT FURTHER NON-CRITICAL BURNS	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	16-27	LACK OF ULLAGE CAPABILITY	LAUNCH	A. NOT APPLICABLE	
			EO	B. NO-GO FOR TLI CONTINUE MISSION IN EO WITH SUITABLE ALTERNATE	
			TLC	C. NO-GO FOR LOI/DOI	
			LO	D. ENTER NEXT BEST PTP	PRECLUDES LM RESCUE
			UNDOCKED	E. REDOCK	
			ALL OTHERS	F. CONTINUE MISSION INHIBIT NON-CRITICAL BURNS IF POSSIBLE	
	16-28	DELTA P BETWEEN FUEL AND OX TANK PRESSURES GREATER THAN 20 PSI AND UNABLE TO DECREASE	LAUNCH	CONTINUE MISSION	MALF PROC--- SPS 1C
			EO	ENTER NEXT BEST PTP RCS DEORBIT	
			TLC	NO-GO FOR LOI/DOI	
			LO	PLAN TEI ASAP WITH LM DPS	
			UNDOCKED	DO NOT STAGE LM DOCK ASAP	
				RETURN TO CSM OR ATTEMPT CSM RESCUE	
			ALL	CONTINUE MISSION	
		A. DURING NON-CRITICAL BURN	OTHERS	A. TERMINATE BURN INHIBIT FURTHER NON-CRITICAL BURNS	
		B. DURING CRITICAL BURN		B. CONTINUE BURN INHIBIT FURTHER NON-CRITICAL BURNS	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	16-29	LEAK OR COMPLETE LOSS OF HELIUM SUPPLY PRESSURE OR BOTH HELIUM VALVES FAIL CLOSED.			• BLOWDOWN DELTA V REMAINING IS A FUNCTION OF ULLAGE VOLUME AT TIME OF FAILURE.
			LAUNCH	A. CONTINUE MISSION	MALF PROC--- SPS 7&8
			EO	B. NO-GO FOR TLI CONTINUE MISSION IN EO IF SUFFICIENT ULLAGE BLOWDOWN DELTA V CAPABILITY EXISTS	
			TLC	C. NO-GO FOR LOI/DOI/PDI	
			LO	D. NO-GO FOR UNDOCKING	
			UNDOCKED	E. DOCK ASAP	
			ALL OTHERS	F. CONTINUE MISSION	
		RULE NUMBERS 16-30 THROUGH 16-49 ARE RESERVED.			

INSTRUMENTATION REQUIREMENTS

R	ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
	16-50	OX TK PRESS	SP0003P	METER/C&W	COMMON	M O/B	16-20, 28
		OX SM/ENG INTERFACE P	SP0931P	-	-	HD	16-20,29
		FU TK PRESS	SP0006P	METER/C&W	COMMON	M O/B	16-20, 28
		FU SM/ENG INTERFACE P	SP0930P	-	-	HD	16-20, 28
		SPS VLV ACT PRESS-PRI	SP0600P	METER	COMMON		16-21, 22
		SPS VLV ACT PRESS-SEC	SP0601P	METER	COMMON	-1 OF 2 M O/B	16-21, 22
		SPS FU FEEDLINE TEMP	SP0048T	METER	COMMON		16-24
		SPS OX FEEDLINE TEMP	SP0049T	SYS TEST	COMMON	-1 OF 2 M	
		ENG CHAMBER PRESS	SP0661P	METER	COMMON	M O/B	16-26
		HE TK PRESS	SP0001P	METER	SEPARATE	1 OF 2 M	16-29
		FU/OX VLV 1 POS	SP0022H	DISPLAY	SEPARATE M		16-21, 26
		FU/OX VLV 2 POS	SP0023H	DISPLAY	SEPARATE M	1 OF 2 O/B	16-21, 26
		FU/OX VLV 3 POS	SP0024H	DISPLAY	SEPARATE M	1 OF 2 O/B	16-21, 26
		FU/OX VLV 4 POS	SP0025H	DISPLAY	SEPARATE M		16-21, 26
		OX TK 1 QTY - TOTAL AUX	SP0655Q	DISPLAY	COMMON	HD	16-10, 11, 13
		OX TK 2 QTY	SP0656Q	DISPLAY	COMMON	HD	16-10, 11, 13
		FU TK 1 QTY - TOTAL AUX	SP0657Q	DISPLAY	COMMON	HD	16-10, 11, 13
		FU TK 2 QTY	SP0658Q	DISPLAY	COMMON	HD	16-10, 11, 13

17 CSM SM–RCS

R	ITEM	
		GENERAL
	17-1	LAUNCH THE LOSS OF ONE QUAD IS NOT CAUSE FOR ABORT AND THERE ARE NO SINGLE FAILURES NOR ANY REASONABLE REALISTIC COMBINATION OF FAILURES WHICH LEAD ONLY TO LOSS OF MULTIPLE QUADS. THERE ARE, THEREFORE, NO SM-RCS FAILURES WHICH ARE CONSIDERED CAUSE FOR ABORT.
	17-2	EARTH ORBIT PHASE A. LOSS OF ONE QUAD, IN ITSELF, IS NOT NECESSARILY CAUSE FOR EARLY TERMINATION OF THE MISSION. THE GUIDELINE IS THAT AS LONG AS THE SPACECRAFT ATTITUDE CAN BE CONTROLLED AND THE SPS CAN BE BURNED THE MISSION NEED NOT BE TERMINATED EARLY. HOWEVER, LOSS OF ONE QUAD WILL REQUIRE TLI BE INHIBITED AND MAY LEAD TO EARLY MISSION TERMINATION SINCE THE CAPABILITY TO PERFORM SM OR HYBRID DEORBIT WILL BE AFFECTED. B. LOSS OF TWO OR MORE QUADS IS CAUSE FOR ENTRY INTO THE NEXT BEST PTP. 1. LOSS OF TWO ADJACENT QUADS WILL DESTROY THE CAPABILITY TO PERFORM ULLAGE MANEUVERS AND WILL REQUIRE DELETION OF NON-CRITICAL SPS MANEUVERS. LOSS OF TWO ADJACENT QUADS PRECLUDES SM OR HYBRID DEORBIT. 2. LOSS OF TWO OPPOSITE QUADS WILL DESTROY THE CAPABILITY TO PERFORM PRECISE 3-AXIS ATTITUDE CONTROL AND PRECLUDES SM OR HYBRID DEORBIT.
	17-3	TRANSLUNAR COAST LOSS OF ONE QUAD IS NOT CAUSE FOR TLC TERMINATION OR LOI INHIBIT. TD+E WILL CONTINUE AS LONG AS THE SM RCS CAN PROVIDE 3-AXIS ATTITUDE CONTROL AND 3 AXIS TRANSLATION CONTROL.
	17-4	LUNAR ORBIT LOSS OF ONE QUAD IS NOT, IN ITSELF, CAUSE FOR EARLY TERMINATION OF LUNAR ORBIT OR LUNAR STAY PHASES. UNDOCKING WILL BE NO-GO BECAUSE LOSS OF ONE QUAD PRECLUDES CSM ACTIVE DOCKING. LOSS OF TWO QUADS IS CAUSE FOR TERMINATING LUNAR ORBIT OR LUNAR STAY PHASES, AND IS ALSO CAUSE FOR PERFORMING TEI WITH THE LM DPS OR RETAINING THE LM ASCENT STAGE THROUGH TEI FOR ATTITUDE CONTROL.
		RULE NUMBERS 17-5 THROUGH 17-14 ARE RESERVED.

R	ITEM	
		' SYSTEMS MANAGEMENT '
	17-15	PROPELLANT GAGING A. PRIME METHOD---RTCC EQUATION (6 PERCENT). B. BACKUP METHOD---HELIUM PRESSURE/TEMPERATURE (11 PERCENT) (ONBOARD)
	17-16	QUAD PROPELLANT BALANCE PROP ISOLATION VALVES WILL NOT BE USED FOR QUAD PROPELLANT BALANCE. PROPELLANT BALANCE WILL BE ACCOMPLISHED BY SELECTING TWO-JET +X AND -X TRANSLATIONS WITH EITHER THE PITCH OR YAW QUAD AND BY CHOOSING SUITABLE JETS FOR ATTITUDE CONTROL. PROPELLANT DIFFERENCES BETWEEN QUADS WILL BE MAINTAINED WITHIN +/- 50 POUNDS.
	17-17	SECONDARY PROPELLANT FUEL PRESSURE VALVE THE RCS SECONDARY FUEL PRESSURIZATION VALVE WILL BE OPENED FOLLOWING TD + E OR WHEN THE PRIMARY FUEL MANIFOLD PRESSURE REACHES 150 PSIA OR RTCC SHOWS 119 LBS WILL BE REACHED DURING A TRANSLATION MANEUVER, WHICHEVER COMES FIRST.
		RULE NUMBERS 17-18 THROUGH 17-19 ARE RESERVED.

MISSION RULES

SECTION 17 - CSM SM-RCS

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC MISSION RULES	
	17-20	SUSTAINED LEAK IN HELIUM TANK			• MALF PROC--- RCS 2
		A. ONE OR MORE QUADS	LAUNCH	A. CONTINUE MISSION	• QUAD WILL REMAIN USABLE UNTIL HE MANIFOLD PRESSURE REACHES 75 PSI
		B. ONE QUAD (ALL OTHER QUADS NORMAL)	EO	B.1. NO-GO FOR TLI	
			TLC	2. CONTINUE MISSION	
			LO	3. NO GO FOR DOI OR UNDOCKING	
			UNDOCKED	4. DOCK ASAP	
			DESCENT/ LUNAR STAY	5. CONTINUE MISSION	
		C. MORE THAN ONE QUAD	EO	C.1. CONTINUE MISSION ENTER PRIOR TO LOSS OF HYBRID DEORBIT CAPABILITY	
			TLC	2.(A) NO GO FOR LOI	
				(B) CONTINUE MISSION IF SUFFICIENT BLOWDOWN CAPABILITY EXISTS	
			DESCENT	3. CONTINUE MISSION	
			ALL OTHERS	4. TERMINATE PHASE AND ENTER NEXT BEST PTP	C.4.(A) IN LUNAR ORBIT, DO DPS TEI. (B) RETAIN LM ASCENT STAGE THRU TEI DEPENDING UPON LM RCS PROPELLANT REMAINING.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	17-21	SUSTAINED LEAK BELOW HE ISOLATION VALVE (COULD BE HELIUM OR FUEL OR OXIDIZER)			• MALF PROC--- RCS 1C • QUAD WILL REMAIN USABLE UNTIL HE MANIFOLD PRESSURE REACHES 75 PSI.
		A. ONE OR MORE QUADS	LAUNCH	A. CONTINUE MISSION	
		B. ONE QUAD (ALL OTHER QUADS NORMAL)	EO	B.1. NO-GO FOR TLI	
			TLC	2.(A) NO GO FOR LOI	
				(B) ENTER NEXT BEST PTP IF LM NOT AVAILABLE	
			LO	3. NO GO FOR DOI OR UNDOCKING	
			UNDOCKED	4. DOCK ASAP	
			DESCENT	5. CONTINUE MISSION	
			LUNAR STAY	6. CONTINUE MISSION	
		C. MORE THAN ONE	DESCENT	C.1. CONTINUE MISSION	
			ALL OTHER	2. TERMINATE PHASE AND ENTER NEXT BEST PTP.	C.2.(A) IN LUNAR ORBIT DO DPS TEI. (B) RETAIN LM ASCENT STAGE FOR TEI DEPENDING UPON LM APS/ RCS PROPELLANT REMAINING.
	17-22	PACKAGE TEMP LESS THAN 55 DEG F. AND UNABLE TO INCREASE	LAUNCH	NOT APPLICABLE	• MALF PROC--- RCS 1A
		A. ONE QUAD (ALL OTHER QUADS NORMAL)	EO	A.1. NO-GO FOR TLI	
			TLC	2.(A) CONTINUE MISSION	
			LO	3. NO GO FOR DOI OR UNDOCKING	
			UNDOCKED	4. DOCK ASAP	
			DESCENT	5. CONTINUE MISSION	
			LUNAR STAY	6. CONTINUE MISSION	
		B. MORE THAN ONE QUAD	DESCENT	B.1. CONTINUE MISSION	
			ALL OTHER	2. TERMINATE PHASE AND ENTER NEXT BEST PTP.	B.2.(A) IN LUNAR ORBIT DO DPS TEI (B) RETAIN LM ASCENT STAGE FOR TEI DEPENDING UPON LM APS/ RCS PROPELLANT.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	17-23	LOSS OF INDIVIDUAL THRUSTERS OR THRUSTER COMBINATIONS AS A RESULT OF CLOGGING, FREEZING, BURNOUT, OR CONTROL SYSTEM MALFUNCTION	LAUNCH	NOT APPLICABLE	CONTROL SYSTEM MALFUNCTION WILL CAUSE LOSS OF AUTO COILS OF THRUSTER ALTHOUGH DIRECT COILS ARE STILL AVAILABLE.
		A. LOSS OF ANY ROLL THRUSTER	LO	A.1. NO-GO FOR UNDOCKING	
			UNDOCKED	2. DOCK ASAP	
			ALL OTHERS	3. CONTINUE MISSION	
		B. LOSS OF FOLLOWING THRUSTER COMBINATIONS---	EO	B.1. CONTINUE ALTERNATE EO MISSION	
		TWO PITCH OR TWO YAW,		IF BOTH SPS AND SM RCS DEORBIT CAPABILITY AND ALL AXIS ATTITUDE CONTROL AVAILABLE	
		ONE PITCH AND ONE YAW,	TLC	2. NO-GO FOR LOI	
		PITCH AND TWO ROLL IN SAME DIRECTION,		3. PLAN TEI FOR NEXT OPPORTUNITY	
		ONE YAW AND TWO ROLL IN SAME	TLC UNDOCKED	4. DOCK ASAP	
			DESCENT	5. CONTINUE MISSION	B.5. RETAIN LM ASCENT STAGE FOR TEI IF LOSS OF ALL THRUSTERS IN ONE DIRECTION IN SAME AXIS
		THREE ROLL IN SAME DIRECTION	LUNAR STAY	6. ENTER NEXT BEST PTP	
		C. LOSS OF +X THRUSTERS ON ADJACENT QUADS.	ALL	C. INHIBIT NON-CRITICAL SPS BURNS	C. REF SPS RULE 16-27, LACK OF ULLAGE CAPABILITY
		RULE 17-24 THROUGH 17-49 ARE RESERVED.			

R | ITEM

' INSTRUMENTATION REQUIREMENTS '

ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
17-50	SM HE TK A PRESS	SR5001P	METER	COMMON		17-20, 21
	QTY SM-RCS PROP SYS A	SR5025Q	METER	COMMON	-1 OF 2 M	17-20, 21
	SM HE TK B PRESS	SR5002P	METER	COMMON		17-20, 21
	QTY SM-RCS PROP SYS B	SR5026Q	METER	COMMON	-1 OF 2 M	17-20, 21
	SM HE TK C PRESS	SR5003P	METER	COMMON		17-20, 21
	QTY SM-RCS PROP SYS C	SR5027Q	METER	COMMON	-1 OF 2 M	17-20, 21
	SM HE TK D PRESS	SR5004P	METER	COMMON		17-20, 21
	QTY SM-RCS PROP SYS D	SR5028Q	METER	COMMON	-1 OF 2 M	17-20, 21
	SM ENG PKG A TEMP	SR5065T	METER/C&W	COMMON	HD	17-22
	SM ENG PKG B TEMP	SR5066T	METER/C&W	COMMON	HD	17-22
	SM ENG PKG C TEMP	SR5067T	METER/C&W	COMMON	HD	17-22
	SM ENG PKG D TEMP	SR5068T	METER/C&W	COMMON	HD	17-22
	SM HE TK A TEMP	SR5013T	METER	COMMON	HD	17-20, 21
	SM HE TK B TEMP	SR5014T	METER	COMMON	HD	17-20, 21
	SM HE TK C TEMP	SR5015T	METER	COMMON	HD	17-20, 21
	SM HE TK D TEMP	SR5016T	METER	COMMON	HD	17-20, 21
	SM HE MAN A PRESS	SR5729P	-----	------	HD	17-20, 21
	SM HE MAN B PRESS	SR5776P	-----	------	HD	17-20, 21
	SM HE MAN C PRESS	SR5817P	-----	------	HD	17-20, 21
	SM HE MAN D PRESS	SR5830P	-----	------	HD	17-20, 21
	SM FU MAN A PRESS	SR5737P	METER/C&W	COMMON	HD	17-12, 21
	SM FU MAN B PRESS	SR5784P	METER/C&W	COMMON	HD	17-12, 21
	SM FU MAN C PRESS	SR5822P	METER/C&W	COMMON	HD	17-12, 21
	SM FU MAN D PRESS	SR5823P	METER/C&W	COMMON	HD	17-12, 21
	SM OX MAN A PRESS	SR5733P	-----	------	HD	17-21
	SM OX MAN B PRESS	SR5780P	-----	------	HD	17-21
	SM OX MAN C PRESS	SR5820P	-----	------	HD	17-21
	SM OX MAN D PRESS	SR5821P	-----	------	HD	17-21

R	ITEM	
		' GENERAL '
	18-1	LAUNCH
		A. A SUSTAINED LEAK IN OR THE LOSS OF HELIUM SUPPLY PRESSURE OR HELIUM MANIFOLD PRESSURE IN ONE CM RCS RING IS NOT CAUSE FOR ABORT SINCE THE REMAINING RING IS CAPABLE OF ABORT OR ENTRY ATTITUDE CONTROL. THIS FAILURE WILL REQUIRE ENTRY INTO PTP 6-4 SINCE SYSTEMS ARE NO LONGER REDUNDANT.
		B. A SUSTAINED LEAK IN OR THE LOSS OF HELIUM SUPPLY PRESSURE OR HELIUM MANIFOLD PRESSURE IN BOTH CM RCS RINGS PRIOR TO TOWER JETTISON IS JUSTIFICATION FOR A MODE I ABORT. AFTER TOWER JETTISON, IT IS NOT CAUSE FOR ABORT SINCE THE ABILITY TO PERFORM A SAFE ENTRY INTO THE ATLANTIC AT THE END OF THE FIRST REV STILL EXISTS BY USING THE CONTINGENCY SM RCS SPIN UP PRIOR TO CM/SM SEP. THIS METHOD OF ENTRY IS CONSIDERED OPERATIONALLY PREFERABLE TO PERFORMING AN ABORT AND PRESENTS LESS POTENTIAL HAZARD TO CREW RECOVERY. FURTHERMORE, CM RCS CONTROL IS REQUIRED FOR ABORTS IN THE MODE II AND MODE III REGIONS, AND TO ABORT THE LAUNCH IN THESE REGIONS FOR LOSS OF CM RCS CAPABILITY WOULD PUT THE SPACECRAFT AND CREW INTO AN UNSAFE ENVIRONMENT.
	18-2	LUNAR ORBIT, LUNAR STAY PHASES
		A. LUNAR ORBIT ACTIVITIES WILL BE TERMINATED FOR LOSS OR IMPENDING LOSS OF ONE CM RCS SYSTEM.
		B. THESE PHASES WILL BE CONTINUED IF THE CM-RCS IS ARMED.
		C. LOSS OF ONE SYSTEM IS CAUSE FOR ENTRY INTO THE NEXT BEST PTP.
	18-3	LM DESCENT PHASE
		THERE ARE NO CSM RCS FAILURES THAT ARE CAUSE FOR TERMINATING THE DESCENT PHASE.
	18-4	ALL OTHER PHASES
		A. SUSTAINED LEAK IN OR LOSS OF HELIUM SUPPLY PRESSURE OR HELIUM MANIFOLD PRESSURE (COULD BE EITHER FUEL OR OXIDIZER) IN ONE CM RCS RING DELETES THE REDUNDANCY OF THE ENTRY ATTITUDE CONTROL SYSTEM AND REDUCES THE DELTA V AVAILABLE FOR HYBRID DEORBIT. LOSS OF HELIUM SUPPLY PRESSURE OR HELIUM MANIFOLD PRESSURE IN BOTH CM RCS RINGS DELETES ALL ENTRY ATTITUDE CONTROL CAPABILITY REQUIRING CONTINGENCY SM RCS SPIN UP PRIOR TO CM/SM SEP. THE LOSS OF ONE OR BOTH CM RCS RINGS IS CAUSE FOR TERMINATING THE PHASE AND MISSION BY ENTRY INTO THE NEXT BEST PTP.
		B. ARMING OF THE CM RCS RINGS, WHETHER THE PROPELLANT ISOLATION VALVES ARE OPENED OR CLOSED, IS CAUSE FOR TERMINATING THE PHASE AND MISSION INTO THE NEXT BEST PTP.
		C. LOSS OF BOTH RINGS IS CAUSE FOR RETAINING THE LM ASCENT STAGE.
		RULE NUMBERS 18-5 THROUGH 18-9 ARE RESERVED.

R	ITEM	
		' SYSTEMS MANAGEMENT '
	18-10	THRUSTER TEMP CONTROL CM RCS THRUSTERS MAY BE HEATED PRIOR TO ENTRY FOR 20 MINUTES OR UNTIL THE LOWEST INDICATED TEMPERATURE IS 28 DEG. F., WHICHEVER COMES FIRST. IF THRUSTER(S) HEATER FUNCTION FAILS, CM RCS IS STILL CONSIDERED OPERATIONAL PENDING RESULTS OF CM RCS CHECKOUT PRIOR TO ENTRY. MALF PROC RCS 5.
	18-11	HELIUM INTERCONNECT AS A LAST RESORT, IF THE HELIUM IN ONE RING IS DEPLETED DUE TO A LEAK AND THE PROPELLANT IS DEPLETED IN THE OTHER RING, THE SYSTEMS MAY BE INTERCONNECTED IF THE REMAINING PROPELLANT IS REQUIRED FOR CONTROL. ONCE INTERCONNECTED, THE RINGS CANNOT BE ISOLATED. MALF PROC RCS 4.
		RULE NUMBERS 18-12 THROUGH 18-19 ARE RESERVED.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC MISSION RULES	
	18-20	SUSTAINED LEAK IN OR COMPLETE LOSS OF OF HELIUM SUPPLY PRESSURE			
		A. ONE RING	LAUNCH	A.1. CONTINUE MISSION AND ENTER PTP 6-4	
			DESCENT	2. CONTINUE MISSION	
			ALL OTHERS	3. TERMINATE PHASE AND ENTER NEXT BEST PTP	A.3. NORMAL ENTRY
		B. BOTH RINGS	LAUNCH	B.1. CONTINUE MISSION AND ENTER PTP 2-1. UNLESS PRIOR TO TOWER JETTISON. IF PRIOR TO TOWER JETTISON, ABORT	
			DESCENT	2. CONTINUE MISSION	
			ALL OTHERS	3. TERMINATE PHASE AND ENTER NEXT BEST PTP	B.3. CONTINGENCY SM RCS SPINUP PRIOR TO CM/SM SEP FOR DEORBIT AND TBD FOR LUNAR RETURN ENTRY.
	18-21	SUSTAINED LEAK IN OR COMPLETE LOSS OF HELIUM MANIFOLD PRESSURE (COULD BE EITHER FUEL OR OXIDIZER)			
		A. ONE RING	LAUNCH	A.1. CONTINUE MISSION AND ENTER PTP 6-4	
			DESCENT	2. CONTINUE MISSION	
			ALL OTHERS	3. TERMINATE PHASE AND ENTER NEXT BEST PTP	
		B. BOTH RINGS	LAUNCH	B.1. CONTINUE MISSION AND ENTER PTP 2-1 UNLESS PRIOR TO TOWER JETTISON. IF PRIOR TO TOWER JETTISON, ABORT.	
			DESCENT	2. CONTINUE MISSION	
			ALL OTHERS	3. TERMINATE PHASE AND ENTER NEXT BEST PTP	B.3 CONTINGENCY SM RCS SPINUP PRIOR TO CM/SM SEP FOR DEORBIT AND TBD FOR LUNAR RETURN ENTRY.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	18-22	CM RCS IS ARMED FOR ANY REASON	LO/ DESCENT/ LUNAR STAY	CONTINUE MISSION	
			ALL OTHERS	TERMINATE PHASE AND ENTER NEXT BEST PTP	
		RULE NUMBERS 18-23 THROUGH 18-49 ARE RESERVED.			

R | ITEM

INSTRUMENTATION REQUIREMENTS

18-50

MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
CM HE TK A PRESS	CR0001P	METER	COMMON	M	18-20
CM HE TK B PRESS	CR0002P	METER	COMMON	M	18-20
CM TK A TEMP	CR0003P	METER	COMMON	HD	18-20
CM TK B TEMP	CR0004P	METER	COMMON	HD	18-20
CM HE MNFLD A PRESS	CR0035P	METER/C&W	SEPARATE	M	18-21
CM HE MNFLD B PRESS	CR0036P	METER/C&W	SEPARATE	M	18-21

R	ITEM	
		' GENERAL '
	19-1	TO INITIATE AND CONTINUE THE FOLLOWING MISSION PHASES, THE EXTRAVEHICULAR MOBILITY UNIT (EMU) MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES--- A. DOCKED (TUNNEL HARDWARE INSTALLED)/UNDOCKED/RNDZ ANY COMBINATION OF TWO OPS AND/OR PLSS UNITS WITH SUFFICIENT O2 CONSUMABLES TO SUPPORT A 30 MINUTE CONTINGENCY EVT (CEVT) B. EVA 1. CRITICAL INSTRUMENTATION 2. THERMAL CONTROL 3. EMU PRESSURE INTEGRITY 4. PRIMARY OXYGEN SUBSYSTEM 5. PLSS FAN 6. PLSS POWER SUPPLY 7. OPS O2 PRESSURE REGULATION 8. CONTAMINATION CONTROL 9. SUFFICIENT PLSS CONSUMABLES TO SUPPORT CHECKOUT, PLANNED EVA AND A 30 MINUTE POST-EVA RESERVE. 10. SUFFICIENT OPS CONSUMABLES TO SUPPORT 30 MINUTE PURGE OPERATIONS AT HIGH PURGE FLOW. 11. BSLSS IF TRAVERSE DISTANCE IS GREATER THAN 1 KM FROM LM.

R	ITEM
	19-2

DEFINITIONS

LOSS OF EMU PRESSURE INTEGRITY

1. UNABLE TO MEET 0.3 PSI/MIN PRESSURE DECAY CRITERIA DURING EMU PRESSURE INTEGRITY CHECK.
2. EMU REGULATED PRESSURE LESS THAN 3.75 PSID (TM) AND DECREASING ON LUNAR SURFACE WHICH REPRESENTS AN O2 USAGE RATE GREATER THAN 0.7 LBS/HR

LOSS OF PRIMARY OXYGEN SUBSYSTEM (POS)

1. SOURCE PRESSURE LESS THAN 135 PSIA OR 5 PERCENT (INDICATOR)
2. UNABLE TO SUPPLY OXYGEN TO OXYGEN VENTILATION LOOP (OVL)
3. IMPROPER PLSS PRESSURE REGULATION (LESS THAN 3.75 OR GREATER THAN 4.05 PSID)

LOSS OF PLSS POWER SUPPLY

1. PLSS BATTERY VOLTAGE LESS THAN 16.0 VDC AND DECREASING
2. PLSS BATTERY CURRENT DRAIN GREATER THAN 3.0 AMPS AND INCREASING (DOES NOT INCLUDE CHECKOUT)

LOSS OF THERMAL CONTROL

1. LOSS OF LCG/LTL CIRCULATION
2. LCG H2O INLET TEMPERATURE AND SUBLIMATOR O2 OUTLET TEMPERATURE OF 50 DEG F AND INCREASING AND LCG H2O DELTA T LESS THAN 5 DEG F AND DECREASING WITH DIVERTER VALVE IN ''MAX'' POSITION (THIS CONSTITUTES A FAILED SUBLIMATOR)
3. DEPLETED FEEDWATER RESERVOIR OR INABILITY TO SUPPLY H2O TO SUBLIMATOR

EMERGENCY RETURN CAPABILITY

1. THE OPS HIGH PURGE FLOW (8 LBS/HRS)RETURN TRAVERSE CAPABILITY OF 1 KM REPRESENTS A 3 FT/SEC TRAVERSE RATE 300 BTUS CREWMAN HEAT STORAGE, AND 13 MINUTES FOR TERMINATION AND INGRESS.
2. THE OPS LOW PURGE FLOW (4 LBS/HR)/BSLSS RETURN TRAVERSE CAPABILITY OF 3 KM REPRESENTS A 3 FT/SEC TRAVERSE RATE, 5 MIN FOR BSLSS ACTIVATION/DEACTIVATION,AND 13 MIN FOR TERMINATION AND INGRESS.

R	ITEM	
	19-3	CREWMAN MAY ELECT TO ATTEMPT A WET SUBLIMATOR RESTART IF BREAKTHROUGH OCCURS.
	19-4	OPS PURGE CAPABILITY IS REQUIRED FOR EVA.
	19-5	VACUUM TRANSFERS WILL ONLY BE USED IN SUPPORT OF (1) CONTINGENCY INTRAVEHICULAR OR EXTRAVEHICULAR TRANSFERS (CIVT OR CEVT) BETWEEN S/C, AND (2) A LM CABIN REPRESS FAILURE.
	19-6	AN EMU/LM ECS HYBRID LIFE SUPPORT AND COMM CONFIGURATION IS ACCEPTABLE IF WITHIN SYSTEMS CAPABILITIES AND IF REQUIRED TO PRECLUDE TIMELINE IMPACT.
	19-7	CONSIDERING 300 BTU'S AS THE MAXIMUM ACCEPTABLE CREWMAN HEAT STORAGE, THE BSLSS IS REQUIRED AS THE EMERGENCY SYSTEM FOR TRAVERSE IN EXCESS OF 1 KM FROM THE LM.
		RULES 19-8 THRU 19-9 ARE RESERVED.
		' MANAGEMENT '
	19-10	THE PLSS BATTERY IS CONSIDERED TO HAVE A CAPACITY OF 17.4 AMP-HRS.
	19-11	THE PLSS PRIMARY OXYGEN SUBSYSTEM (POS) MUST CONTAIN THE MINIMUM LOADED PRESSURE OF 1025 PSIA TO SATISFY THE FIRST PLANNED EVA. THE SECOND EVA PROFILE WILL BE BASED UPON THE O2 RECHARGE FROM THE LM.
	19-12	THE PLSS FEEDWATER RESERVOIR IS CONSIDERED TO HAVE A NOMINAL LOADING OF 8.5 LBS. UNLESS OTHERWISE INDICATED BY TELEMETRY. SUBSEQUENT PLSS RECHARGES WILL BE CONSIDERED TO PROVIDE 8.5 LBS.
	19-13	THE CONTAMINANT CONTROL ASSEMBLY IS CONSIDERED TO HAVE A 7800 BTU TOTAL METABOLIC CAPABILITY AT METABOLIC RATES OF 1200 BTU/HR OR LESS.
	19-14	SUFFICIENT PLSS AND/OR OPS CONSUMABLES WILL BE RETAINED AT LM LIFTOFF TO SUPPORT A 30 MINUTE CEVA.
	19-15	WHEN THE TRAVERSE DISTANCE IS IN EXCESS OF 1 KM SUFFICIENT FEEDWATER WILL BE RETAINED WITHIN EACH PLSS DURING THE EVA TO PROVIDE BSLSS WALKBACK CAPABILITY.
	19-16	FOR INTERMITTENT PURGING FOR VISOR DEFOGGING, DECONTAMINATION, OR ADDITIONAL COOLING, THE PRIMARY O2 SHUTOFF VALVE SHOULD BE TURNED OFF FOLLOWING OPS ACTIVATION BUT PRIOR TO PURGING.
		RULES 19-17 THROUGH 19-19 ARE RESERVED.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC	
	19-20	LOSS OF EMU PRESSURE INTEGRITY 1. PGA PRESS LESS THAN 3.7 BUT GREATER THAN 3.4 PSID 2. PGA PRESS LESS THAN 3.4 PSID	EVA	ACTIVATE OPS 1. TERMINATE EVA 2. TERMINATE EVA IMMEDIATELY	REF MALF EMU
	19-21	PLSS FAN FAILURE	EVA	TERMINATE EVA IMMEDIATELY 1. ACTIVATE OPS 2. OPEN PGA PURGE VALVE-LOW FLOW	REF MALF EMU
	19-22	CONTAMINATION IN VENTILATION SYSTEM	EVA	TERMINATE EVA IMMEDIATELY 1. ACTIVATE OPS 2. OPEN PGA PURGE VALVE-LOW FLOW	REF MALF EMU
		RULES 19-23 THROUGH 19-29 ARE RESERVED.			

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	19-30	LOSS OF THERMAL CONTROL	EVA	TERMINATE EVA 1. IF ADDITIONAL COOLING IS REQUIRED, ACTIVATE BLSS OR CREWMAN MAY ELECT TO ACTIVATE OPS IN HIGH PURGE FLOW MODE IF LESS THAN 1 KM FROM LM AND CIRCUMSTANCES PERMIT	REF MALF EMU
	19-31	LOSS OF POS	EVA	TERMINATE EVA 1. ACTIVATE OPS 2. IF EMU PRESSURE GREATER THAN 4.05 PSID (CTM) CLOSE POS SHUTOFF VALVE	REF MALF EMU NOTE--- IN THE EVENT OF HIGH PGA PRESSURE, PGA PURGE VALVE MAY BE OPENED FOR PRESSURE RELIEF FOLLOWING OPS ACTIVATION.
	19-32	LOSS OF PLSS POWER	EVA	TERMINATE EVA IMMEDIATELY 1. ACTIVATE OPS 2. OPEN PGA PURGE VALVE LOW FLOW 3. ACTIVATE BLSS OR CREWMAN MAY ELECT TO ACTIVATE OPS IN HIGH PURGE FLOW MODE IF LESS THAN 1 KM FROM LM AND CIRCUMSTANCES PERMIT.	REF MALF EMU
	19-33	LOSS OF CRITICAL INSTRUMENTATION	EVA	TERMINATE EVA	REF MR 19-42
				NOTE--- REF SECTION 20 FOR EVA COMMUNICATIONS RULES	
		RULES 19-34 THROUGH 19-40 ARE RESERVED.			

R | ITEM

' INSTRUMENTATION REQUIREMENTS '

19-41 PRELAUNCH INSTRUMENTATION

MEAS DESCRIPTION	FM/FM PAM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
FEED H2O PRESS	GT8110P/GT8210P		COMMON	HD	19-2,3,30
LOW FEED H2O PRESS		TONE-FLAG		M	
PLSS EKG	GT8124J/GT8224J			*	
				'	19,1,2,10,
PLSS BAT CUR	GT8140C/GT8240C			HD	21,32
PLSS BAT VOLT	GT8141V/GT8241V			HD	19-1,2,10,32
LCG H2O TEMP	GT8154T/GT8254T			HD	19-1,2,7,30
PGA PRESS	GT8168P/GT8268P			HD	19-1,2,20,31
PGA PRESS GAGE		CUFF GAGE		M	
LOW PGA PRESS		TONE-FLAG		M	
					19-1,2,3,21,
SUBL O2 OUT TEMP	GT8170T/GT8270T			HD	30,11,14
PLSS-CO2 PP	GT8175P/GT8275P			HD	19-1,13,22
PLSS O2 PRESS	GT8182P/GT8282P		COMMON	HD	19-1,2,20,31
PLSS O2 QTY IND		METER		M	
HIGH O2 FLOW		TONE-FLAG		M	19-1,2,20,31
LOW VENT FLOW		TONE-FLAG		M	19-1,21
LCG H2O DELTA T	GT8196T/GT8296T			HD	
OPS PRESS GAGE		METER		M	19-1,4,14
OPS REG PRESS GAGE		METER		**M	
EVC SYNC	GT8100X/GT8200X			M	
EVC CAL 0 VDC	GT8101V/GT8201V			HD	
EVC CAL 5 VDC	GT8102V/GT8202V			HD	

* AEROMEDICAL PARAMETER REFERENCE SECTION 30.
**1 OF 2 OPS REG PRESS GAGES IS MANDATORY.

19-42 CRITICAL INSTRUMENTATION

MEAS DESCRIPTION	PAM FM/FM	ONBOARD	TRANSDUCER	
PLSS O2 PRESS OR PLSS O2 QTY IND	GT8182P/ GT8282P	METER	COMMON	
PGA PRESS GAGE		CUFF GAGE		
PGA PRESS	GT8168P/ GT8268P			1OF3 M
LOW PGA PRESS TONE		TONE		
LOW VENT FLOW TONE		TONE		
PLSS BAT CURRENT	GT8140C/ GT8240C			1OF3 M
SUBL O2 OUT TEMP	GT8170T/ GT8270T			

R	ITEM	
		GENERAL
	20-1	A. BASELINE REQUIREMENTS (ALL PHASES EXCEPT LAUNCH) 1. TWO-WAY VOICE COMM BETWEEN SPACECRAFT. 2. TWO-WAY VOICE COMM BETWEEN CSM OR LM AND MSFN DURING ALL DOCKED ACTIVITIES AND BETWEEN BOTH SPACECRAFT AND MSFN DURING UNDOCKED ACTIVITIES. B. LAUNCH THERE ARE NO COMMUNICATIONS FAILURES FOR WHICH THE LAUNCH/ INSERTION PHASE WILL BE TERMINATED. C. POWERED DESCENT ADDITIONAL REQUIREMENTS. LM VOICE REQUIRED TILL LO GATE. THERE ARE NO CSM COMMUNICATIONS SYSTEMS FAILURES FOR WHICH LM POWERED DESCENT WILL BE TERMINATED. D. LUNAR STAY ADDITIONAL REQUIREMENTS. 1. FOR TWO-MAN EVA---VOICE COMM BETWEEN MSFN AND ONE EVA PLUS DUPLEX VOICE BETWEEN BOTH EVA CREWMAN. 2. FOR ONE-MAN EVA---VOICE COMM BETWEEN MSFN AND LM OR EVA PLUS DUPLEX VOICE BETWEEN THE LM AND EVA CREWMAN. E. THE LM WILL BE RETAINED FOR TEC COMM IN EVENT OF LOSS OF ALL COMM BETWEEN THE CSM AND THE GROUND.
	20-2	VHF EVA COMMUNICATIONS PRIORITIES ARE--- A. TWO-MAN EVA 1. PRIME---EVA-1 AR/EVA-2 AR (RELAY MODE-ALLOWS DUPLEX VOICE BETWEEN EVA'S PLUS THE TRANSMISSION OF VOICE AND DATA FROM BOTH EVA'S TO LM, PLUS THE RECEPTION OF VOICE VIA LM BY BOTH EVA'S) 2. BACKUP---EVA-1 AR/EVA-2B OR EVA-1 A/EVA-2B OR EVA-1 B/EVA-2A (EITHER MODE COMBINATION ALLOWS DUPLEX VOICE BETWEEN EVA'S PLUS THE TRANSMISSION OF VOICE FROM BOTH THE EVA'S TO THE LM PLUS THE TRANSMISSION OF DATA FROM ONE EVA TO THE LM AND THE RECEIVING OF LM VOICE BY ONE EVA.) B. ONE-MAN EVA 1. PRIME---EVA-1A OR EVA-2A (ALLOW DUPLEX VOICE BETWEEN EVA AND THE LM PLUS THE TRANSMISSION OF DATA FROM EVA TO LM) 2. BACKUP---EVA-1B OR EVA-2B (ALLOWS DUPLEX VOICE BETWEEN EVA AND LM)
		RULES 20-3 THROUGH 20-6 ARE RESERVED.

R	ITEM	
		' MANAGEMENT '
	20-7	VOICE CONFIGURATION

A. LM/CSM/MSFN

1. VHF DUPLEX B AND USB WILL BE TRANSMITTED/RECEIVED SIMULTANEOUSLY FOR LAUNCH THROUGH CYI, REV 1. VHF SIMPLEX A AND USB WILL BE TRANSMITTED/RECEIVED SIMULTANEOUSLY FOR EARTH ORBIT AFTER CYI, REV 1 LOS.

2. VHF A SIMPLEX 296.8 MHZ IS PRIME VOICE COMM BETWEEN VEHICLES EXCEPT DURING RANGING WHEN DUPLEX B (CSM) AND DUPLEX A (LM) WILL BE USED.

3. VHF B SIMPLEX 259.7 MHZ IS BACKUP TO VHF A SIMPLEX 296.8 MHZ.

4. USB IS PRIME VOICE COMM BETWEEN MSFN AND CSM OR LM.

5. USB/VHF RELAY IS VOICE COMM BACKUP TO USB BETWEEN MSFN AND MALFUNCTIONED S/C.

6. NORMAL VOICE COMM WILL USE SIMULTANEOUS MSFN UPLINK TO BOTH VEHICLES. HOWEVER, IF REQUIREMENT SHOULD EXIST, SIMULTANEOUS INDEPENDENT MSFN/CSM AND MSFN/LM COMM MODES WILL BE INITIATED.

7. THE PRIME CSM/LM COMMUNICATIONS MODE DURING THE LUNAR ORBIT PHASE IS VHF. THE PRIME VHF MODE IS VHF A SIMPLEX UNLESS THIS MODE IS PRECLUDED BY THE USE OF VHF RANGING. DURING LUNAR STAY PHASE THE PRIME CSM/LM MODE IS MSFN RELAY.

8. THE CSM AND LM WILL TRANSMIT SIMULTANEOUSLY ON VHF AND USB DURING ALL LM POWERED UP PHASES IN LUNAR ORBIT.

9. IN THE EVENT OF A COMPLETE LOSS OF CSM S-BAND COMMUNICATIONS WITH MSFN, THE LM WILL BE CONFIGURED FOR LM TWO-WAY RELAY AND RETAINED FOR TEI AND TEC.

B. LM/CSM/EVA/MSFN

1. LM TWO-WAY RELAY WITH TWO-MAN EVA IS THE PRIME MODE PLANNED FOR EVA OPERATION. CSM---USB TRANSMIT/RECEIVE ONLY---LM--- TRANSMIT VHF A, RECEIVE VHF A AND B, MSFN CONFIGURED FOR USB RELAY.

20-8 CSM VHF/USB MANAGEMENT

A. FOR CREW REST PERIODS, CSM S-BAND ANTENNAS WILL BE SELECTED BY GROUND COMMANDS.

B. NORMAL CONTROL OF THE S-BAND MODES WILL BE BY GROUND COMMAND. CSM COMMUNICATIONS SWITCH POSITION WILL REFLECT OUT-OF-SITE CONTACT CONFIGURATION.

R	ITEM	
	20-9	LM STEERABLE ANTENNA MANAGEMENT A. DURING ALL PHASES THE STEERABLE ANTENNA TEMPERATURE SHOULD BE MAINTAINED BETWEEN -65 DEG. F AND 185 DEG. F.
	20-10	APOLLO COLOR TELEVISION CAMERA MANAGEMENT A. THE COLOR TV CAMERA WILL NOT BE POINTED SUCH THAT THE SUN WILL BE IN THE FIELD OF VIEW. THE CAMERA MAY BE POINTED NEAR THE SUN--- HOWEVER, IF OBJECTIONABLE FLARE OCCURS, THE GROUND WILL REQUEST THE CAMERA TO BE MOVED. B. THE GROUND WILL MONITOR THE TV PICTURE AND RECOMMEND CAMERA MOVEMENT TO PREVENT IRREVERSIBLE VIDICON TUBE BURNS FROM REFLECTIVE OBJECTS. C. BETWEEN EVA'S THE TV CAMERA WILL BE LOCATED IN THE SUN AND OPERATING TO MINIMIZE THE POSSIBILITY OF FREEZING. D. DELETED E. IF THE THERMAL CONSTRAINTS ON THE CAMERA OPERATING TIME IN THE MESA ARE VIOLATED, THE GROUND WILL REQUEST THE CAMERA BE TURNED OFF. F. DELETED G. WHEN A BRIGHT OBJECT, WITH A CONTRASTING DARK BACKGROUND IS IN THE FIELD OF VIEW, THE GROUND WILL RECOMMEND AN ALC SWITCH SETTING TO GET THE BEST PICTURE. THE ALC-PEAK WILL GIVE THE BEST PICTURE OF THE BRIGHT OBJECT AND THE ALC-AVERAGE WILL GIVE THE BEST PICTURE OF THE DARK BACKGROUND.
		RULES 20-11 AND 20-12 ARE RESERVED.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC	
	20-13	LOSS OF TWO-WAY VHF VOICE COMM BETWEEN SPACECRAFT	DOCKED	CONTINUE	REF LM MAL PROC COMM 3. LOSS OF VHF VOICE COMM WITH CSM
			UNDOCKED	NO GO FOR SEP MNVR DOCK ASAP NO GO FOR CSM CIRC	
			PRE-PDI	CONTINUE MISSION	REF CSM MAL PROCEDURE COMM 5 - LOSS OF VHF COMM WITH LM
			POWERED DESCENT	CONTINUE MISSION	
			LUNAR STAY	CONTINUE MISSION	NOTE---MSFN RELAY MAY BE UTILIZED
	20-14	LOSS OF TWO-WAY VOICE COMM WITH MSFN			REF CSM MAL PROCEDURES 7&8 - LOSS OF CSM VOICE COMM
		A. CSM ONLY	LAUNCH	A.1. CONTINUE MISSION	
			EARTH ORBIT	2. ENTER NEXT BLOCK DATA POINT	
			TLC	3. CONTINUE MISSION NO GO FOR LOI	A.3 ENTER LM EARLY TO USE LM S-BAND FOR VOICE COMM WITH MSFN.
			DOI	4. CONTINUE MISSION NO GO FOR SEP MANEUVER	
			UNDOCKED/ POWERED DESCENT	5. CONTINUE MISSION	
			LUNAR STAY	6. CONTINUE MISSION	UTILIZE VHF OF VHF RELAY FROM LM. IF UNABLE TERMINATE LUNAR STAY AND PERFORM A DOCKED TEI. NOTE--- RETAIN LM FOR COMM DURING TEC
		B. LM ONLY	DOCKED	B.1. CONTINUE MISSION NO GO FOR SEP MANEUVER	. REF LM MAL PROC COMM-- 4 LOSS OF S-BAND VOICE COMM
			UNDOCKED PRE-PDI	2. RETURN TO VICINITY OF CSM NO GO FOR PDI	5A. S-BAND RECEIVER CANNOT ACQUIRE PHASE LOCK.
			POWERED DESCENT	3.A.PDI TO LO GATE RETURN TO VICINITY OF CSM ASAP B.LO GATE TO TOUCHDOWN CONTINUE MISSION.	B.3. CSM RELAY ACCEPTABLE
			LUNAR STAY	5. LM LIFTOFF NEXT ASCENT OPPORTUNITY.	
	20-15	LOSS OF TWO CSM AUDIO CENTERS	EPO	CONTINUE MISSION NO GO FOR TLI	
			ALL	CONTINUE MISSION-NO GO FOR LOI	
	20-16	LOSS OF VOICE FROM EVA-2 TO EVA-1	DUAL EVA	CONTINUE MISSION EVA-2 GO TO POSITION "B"	EVA-1 HAS EVC-1 EVA-2 HAS EVC-2

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	20-17	LOSS OF VOICE FROM EVA-1 TO EVA-2	DUAL EVA	CONTINUE MISSION 1. EVA-2 GO TO POSITION "A" 2. EVA-1 GO TO POSITION "B"	
	20-18	LOSS OF DUPLEX VOICE BETWEEN EVA-1 AND EVA-2	DUAL EVA	TERMINATE EVA	
	20-19	LOSS OF TWO-WAY VOICE BETWEEN MSFN AND EVA	DUAL EVA	TERMINATE EVA 1. EVA-2 GO TO POSITION "A" EVA-1 GO TO POSITION "B" 2. IF UNABLE TO RE-ESTABLISH COMM EVA-2 RETURN TO LM AND RECONFIGURE COMM 3. IF ABLE TO RE-ESTABLISH COMM, CONTINUE EVA.	
	20-20	LOSS OF TWO-WAY VOICE BETWEEN MSFN AND BOTH LM AND EVA	ALT EVA (ONE-MAN)	TERMINATE EVA 1. RECONFIGURE LM TO RE-ESTABLISH COMM. 2. IF ABLE TO RE-ESTABLISH COMM, CONTINUE EVA.	
	20-21	LOSS OF DUPLEX VOICE BETWEEN LM AND EVA	ALT EVA (ONE-MAN)	TERMINATE EVA 1. RECONFIGURE LM AND EVA TO VHF BACKUP MODE. 2. IF ABLE TO RE-ESTABLISH DUPLEX COMM, CONTINUE EVA.	
		RULES 20-22 THROUGH 20-25 ARE RESERVED.			

R	ITEM	
		GENERAL
	20-26	A. BASELINE REQUIREMENT (ALL PHASES EXCEPT LAUNCH) 1. CRITICAL INSTRUMENTATION (CRITICAL INSTRUMENTATION IS THAT INSTRUMENTATION REQUIRED TO VERIFY MISSION GO/NO-GO CRITERIA) B. LAUNCH THERE ARE NO CSM INSTRUMENTATION FAILURES FOR WHICH THE LAUNCH/INSERTION PHASE WILL BE TERMINATED. C. POWERED DESCENT ADDITIONAL REQUIREMENTS THERE ARE NO CSM INST. SYS FAILURES FOR WHICH LM POWERED DESCENT WILL BE TERMINATED.
	20-27	THE MISSION WILL BE CONTINUED WITH THE LOSS OF THE--- A. CSM UPDATA LINK B. CSM CAUTION AND WARNING SYSTEM C. CSM DSE D. CSM HIGH GAIN ANTENNA E. CSM FM DOWNLINK F. CSM USB RANGING (PRN) G. VHF RANGING
		RULES 20-28 THROUGH 20-29 ARE RESERVED.

R	ITEM	
		' MANAGEMENT '
	20-30	DSE MANAGEMENT
		A. LM AND CSM LOW BIT RATE TELEMETRY WILL BE RECORDED CONTINUOUSLY WHEN NOT IN CONTACT WITH GROUND TELEMETRY SITES EXCEPT DURING PERIODS OF VHF RANGING WHEN NO LM TM WILL BE RECORDED, AND WILL BE NORMALLY PLAYED BACK AT LEAST ONCE PER REVOLUTION IN LUNAR ORBIT.
		B. CM HIGH BIT RATE DSE RECORDINGS WILL BE MADE DURING THE FOLLOWING OPERATIONS---
		1. LAUNCH
		2. TLI
		3. S-IVB/CSM SEPARATION
		4. TD&E
		5. ALL SPS MANEUVERS AND MIDCOURSE CORRECTIONS
		6. DOCKING AND UNDOCKING
		7. CM/SM SEPARATION AND ENTRY
		8. DTO REQUIREMENTS (TBD)
		9. LM FINAL SEP
		C. DURING SLEEP PERIODS
		1. USING HIGH GAIN ANTENNAS, DSE RECORDING AND DUMPING WILL BE MANAGED PER (A) ABOVE.
	20-31	CTE MANAGEMENT
		A. CTE WILL BE CONFIGURED TO CLOCK IN GET FOR FLIGHT, HOWEVER, IF A HOLD OCCURS AFTER T-15 MINUTES, CTE WILL NOT BE CORRECTED UNTIL COMPLETION OF POWERED FLIGHT.
		B. CTE WILL BE ALLOWED TO DRIFT +/-5 SEC BEFORE BEING UPDATED AFTER ORBIT INSERTION.
		RULES 20-32 THROUGH 20-34 ARE RESERVED.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC	
	20-35	LOSS OF CSM TM			REF CSM MAL PROCEDURE.
		A. HBR OR LBR	ALL	A. CONTINUE MISSION	COMM 10 - MSFN REPORTS LOSS OF REALTIME PCM. DSE MAY BE UTILIZED FOR TM IF AVAILABLE.
		B. ALL TM	LAUNCH	B.1. CONTINUE MISSION	
			EO	2. ENTER NEXT BEST PTP	
			LO	3. NO GO FOR LUNAR OPERATIONS	
			POWERED DESCENT	4. CONTINUE MISSION	
			LUNAR STAY	5. LM LIFTOFF AT THE NEXT ASCENT OPPORTUNITY.	
	20-36	LOSS OF CRITICAL INSTRUMENTATION	LAUNCH	CONTINUE MISSION	
			EO	ENTER NEXT BEST PTP NO GO FOR TLI	
			TLC	CONTINUE MISSION	
				NO GO LOI	
			LO	NO GO FOR LUNAR OPERATIONS	
	20-37	LOSS OF ONE CSM PMP POWER SUPPLY	ALL	CONTINUE MISSION	
	20-38	LOSS OF BOTH CSM POWER AMPLIFIERS	EPO	NO GO FOR TLI	
			ALL	CONTINUE MISSION IF HI GAIN ANT IS AVAILABLE	
	20-39	LOSS OF THE SCE	EPO	CONTINUE MISSION NO GO FOR TLI	
			TLC	CONTINUE MISSION	
			LUNAR ORBIT	CONTINUE MISSION	
			LUNAR STAY	CONTINUE MISSION	
		RULES 20-40 THROUGH 20-44 ARE RESERVED.			

R	ITEM	
		' GENERAL '
	20-45	A. BASELINE REQUIREMENT 1. CRITICAL INSTRUMENTATION (CRITICAL INSTRUMENTATION IS THAT INSTRUMENTATION, ONBOARD OR TM DURING MSFN AOS, OR ONBOARD ONLY DURING MFSN LOS REQUIRED TO VERIFY MISSION GO/NO-GO CRITERIA) B. POWERED DESCENT ADDITIONAL REQUIREMENTS LM HBR TELEMETRY C. LUNAR STAY ADDITIONAL REQUIREMENTS LM LBR OR HBR TM IS REQUIRED. IF LM TM DATA IS LOST DURING THE EVA, ONE CREWMAN WILL RETURN AND ATTEMPT TO RE-ESTABLISH THE LOST COMMUNICATIONS LINK.
	20-46	THE MISSION WILL BE CONTINUED WITH THE LOSS OF THE--- A. LM UPDATA LINK B. LM CAUTION AND WARNING SYSTEM C. LM DSEA D. EVA TELEMETRY E. LM FM DOWNLINK F. LM USB RANGING (PRN) G. VHF RANGING
		RULES 20-47 THROUGH 20-49 ARE RESERVED.

R	ITEM	
		' MANAGEMENT '
	20-50	LM USB/TM MANAGEMENT

A. FOR NORMAL LM POWERED UP PHASES, THE LM STEERABLE ANTENNA WITH THE POWER AMPLIFIER WILL BE USED. DURING LUNAR STAY, IF THE ERECTABLE ANTENNA IS USED, THE POWER AMPLIFIER MAY BE TURNED OFF IF HBR TM AND VOICE CIRCUIT MARGINS ARE ADEQUATE.

B. DURING PERIODS OF LM OUT-OF-STATION CONTACT (LUNAR FAR SIDE), THE TM BIT RATE WILL BE SWITCHED FROM HBR TO LBR AND TRANSMITTED TO THE CSM OVER VHF B EXCEPT DURING VHF RANGING AND PERIODS OF CRITICAL VOICE COMMUNICATIONS.

SYSTEM MONITORING

DURING SLEEP PERIODS TBD CREWMEN WILL SLEEP WITH HEADSETS TO MONITOR FOR MASTER ALARMS OR GROUND COMMUNICATIONS.

RULES 20-51 THROUGH
20-54 ARE RESERVED.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC	
	20-55	LOSS OF LM TM			REF LM MAL PROC COMM 6
		A. LOSS OF LBR ONLY	ALL	A. CONTINUE MISSION	
		B. LOSS OF HBR ONLY	ALL	B.1. CONTINUE MISSION	MSFN REPORTS LOSS OF PCM ADEQUATE DATA TO MAKE FINAL GO/NO GO TO CONTINUE POWERED DESCENT.
		C. LOSS OF ALL TM	DOCKED	C.1. CONTINUE MISSION-NO GO FOR UNDOCKING	
			ALL	2. RETURN TO VICINITY OF CSM	
			POWERED DESCENT	3.(A) PDI TO LO GATE - ABORT-DOCK ASAP	
				(B) LO GATE TO TD - CONTINUE MISSION	
			LUNAR STAY	4. LM LIFTOFF NEXT LAUNCH OPPORTUNITY	
	20-56	LOSS OF CRITICAL INSTRUMENTION			
			DOCKED	DO NOT UNDOCK	
			UNDOCKED	DOCK ASAP	
		RULES 20-57 THROUGH 20-59 ARE RESERVED.			

R | ITEM

' CSM- INSTRUMENTATUON REQUIREMENTS '

20-60	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REF
	UDL VALIDITY SIGNAL	CT0262V	-	-	HD	20-27A
	USB RECEIVER AGC	CT0620E	METER	COMMON	HD	20-27,20-7A(9), 20-88
	USB RECEIVER ERROR	CT0604F	-	-	HD	
	DSE TAPE MOTION	CT0012X	TB	-	HD	20-27,20-30
	CTE TIME	CT0145F	-	-	HD	20-31
	SCE 10 VDC	CT0018V	-	-	HD	
	SCE 5 VDC	CT0017V	-	-	HD	
	SCE 20 VDC	CT0015V	-	-	HD	
	SCE -20 VDC	CT0016V	-	-	HD	
	PCM HI REF 85 PERCENT	CT0125V	-	-	HD	
	PCM HI REF 15 PERCENT	CT0126V	-	-	HD	
	HI GAIN ANT POS. PITCH	ST0152H	-	-	HD	
	HI GAIN ANT POS. YAW	ST0153H	-	-	HD	
	HGA BEAM WIDTH SW POS-NAR	CT0161X	-	-	HD	
	HGA BEAM WIDTH SW POS-MED	CT0162X	-	-	HD	
	HGA TRACK SW POS-AUTO	CT0163X	-	-	HD	
	HGA TRACK SW POS-REACQ	CT0164X	-	-	HD	

' LM- INSTRUMENTATION REQUIREMENTS '

20-61	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REF
	PCM OSC FAIL 2	GL0422V	-	-	1 OF 2	
	PCM OSC FAIL 3	GL0423V	-	-	HD	
	CAL 85 PCT	GL0401V	-	-	HD	
	CAL 15 PCT	GL0402V	-	-	HD	
	MET	GL0501W	-	-	HD	
	C&W PWR FAIL	GL4054X	CAUTION	-	HD	
	MASTER ALARM	GL4069X	MASTER ALARM	-	HD	
	DUA STATUS	GT0441X	-	-	HD	20-46
	S-BND ST PH ERR	GT0992B	-	-	HD	
	S-BND RCVR SIG	GT0994V	METER /CAUTION	-	HD	20-46
	STEERABLE ANT TEMP	GT0454	METER /CAUTION	-	HD	20-9B,20-50
	XMTR PO	GT0993	-----	-	HD	20-46,20-55
	VHF B RCVR AGC	GT0625	- - -	-	HD	

R	ITEM	
		GENERAL
	21-1	TO INITIATE MANNED LM MISSION PHASES, THE PYROTECHNIC SYSTEM MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES--- A. DOCKED OPERATIONS ONE OPERATIONAL PYRO SYSTEM B. UNDOCKED/SEPARATION AND SUBSEQUENT PHASES SEE LM TELMU GO/NO GO CRITERIA - PAGE 3-18.
	21-2	DEFINITIONS--- LOSS OF PYRO SYSTEM A. PYRO BATTERY OPEN CIRCUIT VOLTAGE LESS THAN 35 VDC B. UNABLE TO ARM SYSTEM
	21-3	A PYRO SYSTEM WILL BE DISABLED IF--- A. ANY RELAY K2 THROUGH K6 INADVERTENTLY CLOSES (REF MR 21-13) B. ANY RELAY K7 THROUGH K15 INADVERTENTLY CLOSES. SYSTEM WILL BE USED FOR APS PRESSURIZATION, DPS VENTING AND STAGING A PYRO SYSTEM IS DISABLED BY OPENING THE APPROPRIATE ''LOGIC POWER'' CIRCUIT BREAKER
	21-4	THE ASCENT AND DESCENT STAGES ARE CONSIDERED NON-RIGIDLY ATTACHED IF THE GUILLOTINE FAILS TO SEVER THE INTERSTAGE UMBILICALS AND ALL OTHER INTERSTAGE ATTACHMENT POINTS HAVE RELEASED.
	21-5	ANY SPECIFIC PYRO MISSION RULE REQUIRING A NEXT BEST OPPORTUNITY LIFTOFF WILL BE CAUSE FOR TERMINATION OF AN EVA. ADDITIONALLY, SHOULD A PYRO SYSTEM EXHIBIT A K1-K6 RELAY CLOSURE DURING THE EVA, ONE CREWMAN WILL RETURN AND ATTEMPT TO CORRECT THE MALFUNCTION.
	21-6	THE NEXT BEST OPPORTUNITY FOR LIFTOFF AFTER TOUCHDOWN IS CONSIDERED TO BE T3 IN THESE RULES. THERE ARE NO SINGLE PYRO FAILURES THAT WOULD CAUSE A T1 OR T2 LIFTOFF
		RULE NUMBERS 21-7 THROUGH 21-9 ARE RESERVED.

R	ITEM	
		MANAGEMENT
	21-10	APS WILL NOMINALLY BE PRESSURIZED IMMEDIATELY PRIOR TO STAGING. APS WILL NOT NORMALLY BE PRESSURIZED MORE THAN 24 HOURS PRIOR TO THE LAST APS BURN--- HOWEVER, IN A CONTINGENCY CASE, THE APS MAY BE PRESSURIZED UP TO 3-1/2 DAYS PRIOR TO THE LAST APS BURN.
	21-11	IF UNABLE TO DEPLOY ONE OR MORE LANDING GEAR, A LANDING WILL NOT BE ATTEMPTED. DESCENT ENGINE BURNS WILL BE CONTINUED SINCE CONTROL PROBLEMS ARE NOT EXPECTED TO EXIST AND DAMAGE TO THE LANDING GEAR FROM THE BURN WILL NOT AFFECT ALTERNATE MISSIONS.
	21-12	UNDOCKED STAGING WITH ONE PYRO SYSTEM WILL BE PERFORMED ONLY IF ABSOLUTELY NECESSARY TO MAINTAIN CREW SAFETY.
	21-13	FOR A K1 THROUGH K6 FAILURE, THE GOOD SYSTEM WILL BE DISABLED AND A PYRO FUNCTION, OTHER THAN STAGING, ATTEMPTED (WITH THE MASTER ARM SWITCH OFF) TO DETERMINE IF K1 HAS FAILED CLOSED. IF BOTH SYSTEMS ARE FAILED IN THIS MODE, THEY MUST BOTH BE TESTED FOR A K1 FAILURE INDEPENDENTLY. A PYRO SYSTEM CANNOT BE DISABLED FOR A K1 FAILURE.
	21-14	AN ARMED PYRO SYSTEM(S) THAT CANNOT BE DEARMED IS CONSIDERED UNSAFE FOR THE VIBRATION/SHOCK ENVIRONMENT ASSOCIATED WITH LUNAR TOUCHDOWN.
		RULE NUMBERS 21-15 THROUGH 21-19 ARE RESERVED.

MISSION RULES

SECTION 21 - LM SEQUENTIAL AND PYROTECHNIC

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC	
	21-20	LOSS OF---			REF MALF PROC ED---
		A. ONE PYRO SYSTEM	ALL	A. 1. DELAY STAGING AS LONG AS POSSIBLE	1 ED RELAY
			DOCKED	2. CONTINUE MISSION	CSM RESCUE MAY BE REQUIRED DUE TO RCS REDLINES
			UNDOCKED	NO-GO CIRC	
			PRE-PDI	3. DOCK ASAP NO-GO PDI	
			POWERED DESCENT	4.(A) PDI TO PDI + 5+30 ABORT (B) PDI + 5+30 TO TD - CONTINUE MISSION	
			LUNAR STAY	5. LIFT OFF AT NEXT BEST OPPORTUNITY	
		B. TWO PYRO SYSTEMS	ALL	B. 1. DOCK ASAP	
			POWERED DESCENT	2. ABORT PRIOR TO 5+30	
	21-21	UNABLE TO DISARM PYRO SYSTEM(S)	ALL	CONTINUE MISSION NO-GO PDI	REF MALF PROC ED---
					1 ED RELAY
				FOR UNSTAGED OPERATION, PLACE ONE ASCENT BATTERY ON BUS POWERING THE ACTIVE GUIDANCE SYSTEMS.	CSM RESCUE MAY BE REQUIRED DUE TO RCS REDLINE
				STAGE AS REQUIRED IN ORBIT	
			POWERED DESCENT	ABORT	
			LUNAR STAY	LIFT OFF AT NEXT BEST OPPORTUNITY NO-GO EVA	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	21-22	A RELAY K7 THROUGH K15 INADVERTENTLY CLOSES	ALL		RELAYS K7 - RCS PRES K8 - LAND GEAR DEPLOY K8A - LAND GEAR DEPLOY K9 - DPS CRYO HE PRESS K10 - ASC HE TANK 1 K11 - ASC HE TANK 2 K12 - ASC FUEL AND OX COMP VALVE (SYSTEM B ONLY) K12A - ASC FUEL AND OX COMP VALVES K13 - DPS FUEL AND OX VENT K14 - DPS AMBIENT HE K15 - DPS FUEL AND OX COMP VALVES
		A. SYSTEM A		A. CONTINUE MISSION OPEN LOGIC POWER ''A'' C/B UNTIL AFTER DPS SHE PRESSURIZATION. CLOSE DES PROPULSION FUEL AND OXID VENTS THEN CLOSE LOGIC POWER ''A'' C/B.	A AND B - PRIOR TO DPS CRYO HE PRESS, THE FAILED SYSTEM WILL BE DISABLED FOR ALL PYRO FUNCTIONS. SUBSEQUENT PYRO FUNCTIONS WILL BE ACCOMPLISHED USING SYSTEMS A AND B.
		B. SYSTEM B		B. CONTINUE MISSION OPEN LOGIC POWER ''B'' C/B UNTIL AFTER DPS SHE PRESSURIZATION. CLOSE DES PROPULSION FUEL AND OXID VENTS THEN CLOSE LOGIC POWER ''B'' C/B.	
		C. BOTH SYSTEMS		C. 1. CONTINUE MISSION 2. PRIOR TO POSITIONING MASTER ARM SW TO ''ON''--- CLOSE DES HE REG 1 AND 2 AND DES PROPULSION FUEL AND OXID VENTS. ALSO, THE DESCENT PROPELLANT ISOL VLV SWITCH MUST BE HELD IN THE FIRE POSITION WHEN THE MASTER ARM SWITCH IS POSITIONED TO ''ON'' FOR THE FIRST TIME. 3. OPEN DES HE REG 1 AT TIG OF DPS 1 BURN	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	21-23	UNABLE TO STAGE			THIS RULE ONLY APPLIES TO ALTERNATE MISSIONS
		A. ASCENT AND DESCENT STAGES STILL RIGIDLY TIED TOGETHER	RNDZ	A. 1. CONTINUE MISSION 2. USE RCS FOR MANEUVERS	A. CSM RESCUE MAY BE INITIATED DUE TO RCS REDLINES
		B. INCOMPLETE STAGING, VEHICLE NOT RIGID	RNDZ	B. 1. EXECUTE CSM RESCUE 2. GO TO DRIFTING FLIGHT	B. EVT MAY BE REQUIRED BECAUSE OF INABILITY TO DOCK.
		RULE NUMBERS 21-24 THROUGH 21-49 ARE RESERVED			

PRELAUNCH INSTRUMENTATION

R	ITEM	MEAS DESCRIPTION	PCM	ONBOARD		CATEGORY	MISSION RULE REFERENCE
	21-50	ED RLY A K1-K6	GY0201X	SYS A STAGING LIGHT	COMMON CAUTION LIGHT	M HD	21-1, 2, 3, 13, 20, 21,
		ED RLY B K1-K6	GY0202X	SYS B STAGING LIGHT		M	21-1, 2, 3, 13, 20, 21,
		ED RLY A K7-K15	GY0231X	--------		HD	21-1, 3, 22
		ED RLY B K7-K15	GY0232X	--------		HD	21-1, 3, 22
		SELECTED ED BAT VOLT	------	METER		M	21-1, 2, 20

R	ITEM	
		GENERAL
	22-1	TO INITIATE MANNED LM MISSION PHASES, THE ELECTRICAL POWER SYSTEM MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES---

NOTE

LM ACTIVE RENDEZVOUS/CONTINGENCY RETURN ASSUMED

A. DOCKED WITH HATCH OPEN AND TUNNEL CLEAR

1. CDR OR LMP BUS
2. TWO DESCENT BATTERIES WITH ASSOCIATED FEEDER OR ONE ASCENT BATTERY WITH ASSOCIATED FEEDER.
3. SUFFICIENT AVAILABLE ASCENT OR DESCENT ELECTRICAL ENERGY TO COMPLETE THE PLANNED ACTIVITY PERIOD.

B. DOCKED WITH HATCH CLOSED

1. CDR AND LMP BUSES
2. TWO DESCENT BATTERIES PLUS ONE ASCENT BATTERY OR BOTH ASCENT BATTERIES.
3. BOTH ASCENT FEEDERS
4. SUFFICIENT AVAILABLE ASCENT OR DESCENT ELECTRICAL ENERGY TO COMPLETE THE PLANNED ACTIVITY PERIOD PLUS A RESERVE OF 1 HOUR.

C. UNDOCKED/SEPARATION AND SUBSEQUENT PHASES SEE LM TELMU GO/NO GO CRITERIA - PAGE 3-18.

R	ITEM	
	22-2	DEFINITIONS--- LOSS OF CDR OR LMP BUS A. INABILITY TO MAINTAIN BUS VOLTAGE GREATER THAN 26.5 VDC B. A BUS CURRENT GREATER THAN OR EQUAL TO 90 AMPS LOSS OF AN EPS BATTERY A. BATTERY OUTPUT LESS THAN OR EQUAL TO 2 AMPS WHEN CONNECTED TO A BUS B. TEMPERATURE GREATER THAN OR EQUAL TO 145 DEG F WITH VOLTAGE EQUAL (UNSTAGED CONFIGURATION) OR LESS THAN NOMINAL (STAGED CONFIGURATION), AND CURRENT LESS THAN NOMINAL C. INABILITY TO MEET VOLTAGE REGULATION AT REQUIRED LOAD D. INABILITY TO BE CONNECTED TO A FEEDER DUE TO A MALFUNCTIONED ECA E. BATTERY OPEN CIRCUIT VOLTAGE BELOW 31.8 VDC STEADY STATE LOSS OF A DC BUS FEEDER A. DESCENT - INABILITY TO USE AS A POWER PATH THE ELECTRICAL CONNECTIONS FROM THE OUTPUT TERMINALS OF THE DESCENT ECA'S TO THE DFR B. ASCENT - INABILITY TO USE AS A POWER PATH THE ELECTRICAL CONNECTIONS FROM THE OUTPUT TERMINALS OF THE ASCENT ECA'S TO THE BAT FEED TIE CIRCUIT BREAKERS LOSS OF OVERCURRENT PROTECTION A. DEFINITE LOSS IF--- (1) BOTH CIRCUIT BREAKERS POWERING THE ECA'S FAIL OPEN (ALL DESCENT OR ALL ASCENT BATTERIES, DEPENDENT ON WHICH PAIR OF CIRCUIT BREAKERS FAILED) (2) FAILURE OF AN ASCENT BATTERY NORMAL FEED CONTACTOR B. PROBABLE LOSS IF--- (1) UNABLE TO MEASURE A BATTERY CURRENT BOTH ONBOARD AND ON TELEMETRY (2) UNABLE TO TAKE THE BATTERY OFF LINE LOSS OF AN INVERTER AND/OR ASSOCIATED AC DISTRIBUTION A. AC BUS VOLTAGE LESS THAN OR EQUAL TO 110.5 OR GREATER THAN OR EQUAL TO 120 VAC B. AC BUS FREQUENCY LESS THAN OR EQUAL TO 390 OR GREATER THAN OR EQUAL TO 410 HZ C. POWER CANNOT BE SUPPLIED TO AN AC BUS
	22-3	ANY SPECIFIC EPS MISSION RULE REQUIRING A NEXT BEST OPPORTUNITY LIFTOFF WILL BE CAUSE FOR TERMINATION OF AN EVA. ADDITIONALLY, A CREWMAN WILL RETURN FROM THE EVA TO CORRECT THE FOLLOWING--- A. A DESCENT BATTERY MALFUNCTION REQUIRING THE BATTERY TO BE TAKEN OFF LINE. B. AN INVERTER MALFUNCTION IF THE STEERABLE ANTENNA IS AFFECTED (ASSUMES THE ERECTABLE ANTENNA IS NOT DEPLOYED). RULE NUMBERS 22-4 THROUGH 22-9 ARE RESERVED.

R	ITEM	
		' MANAGEMENT '
	22-10	THE MISSION WILL BE CONTINUED AFTER LIFTOFF WITH THE LOSS OF OVERCURRENT PROTECTION. IF THIS PROTECTION IS LOST PRIOR TO LIFTOFF, A HOLD WILL BE CALLED. A. IF OVERCURRENT PROTECTION IS LOST ON AN INDIVIDUAL DESCENT BATTERY, THE BATTERY WILL BE LEFT ON LINE EXCEPT FOR EVA. B. IF ALL DESCENT OVERCURRENT PROTECTION IS LOST, BOTH ASCENT BATTERIES WILL BE PARALLELED WITH THE DESCENT BATTERIES ON LINE PERIODICALLY TO MONITOR CURRENT AND OBTAIN A CONSUMABLE TREND. C. IF ONE OR BOTH ASCENT BATTERY NORMAL FEED CONTACTORS FAIL OPEN, THE SPACECRAFT WILL BE CONFIGURED WHEN ASCENT STAGE ONLY OPERATIONS ARE REQUIRED, USING THE BACKUP FEEDS ON BOTH ASCENT BATTERIES WITH THE CROSSTIES LEFT OPEN.
	22-11	THE ASCENT BATTERIES WILL BE PRECONDITIONED FOR--- A. ABORT STAGING WITH TWO ASCENT BATTERIES/SPLIT BUS OPERATION - BY REMOVING A MINIMUM OF 2.5 AMP HOURS FROM THE BATTERY ON THE LMP BUS (NORMALLY BATTERY 5) AND A MINIMUM OF 5 AMP HOURS FROM THE BATTERY ON THE CDR BUS (NORMALLY BATTERY 6) IMMEDIATELY PRIOR TO PDI. B. LUNAR L/O OR STAGING DURING COASTING FLIGHT WITH TWO ASCENT BATTERIES/SPLIT BUS OPERATION - BY REMOVING A MINIMUM OF 2.5 AMP HOURS FROM EACH ASCENT BATTERY IMMEDIATELY PRIOR TO DISCONNECTING THE LAST DESCENT BATTERY FROM EACH BUS. C. LUNAR L/O OR STAGING DURING COASTING FLIGHT WITH ONE ASCENT BATTERY/TWO BUS OPERATION - BY REMOVING A MINIMUM OF 5 AMP HOURS FROM THE REMAINIMG ASCENT BATTERY IMMEDIATELY PRIOR TO DISCONNECTING THE LAST DESCENT BATTERY FROM THE BUSES.
	22-12	THE BAL LOAD CROSSTIES (30A) WILL BE OPEN FOR MAIN PROPULSION BURNS, STAGING, AND WHENEVER AGS IS IN THE OPERATE MODE WITH BOTH ''AEA'' CIRCUIT BREAKERS CLOSED. THE BUS CROSSTIES (100A) WILL NOMINALLY NEVER BE CLOSED.
	22-13	ELECTRICAL POWER WILL NEVER BE INTENTIONALLY APPLIED TO A SHORT TO HELP DETERMINE ITS LOCATION UNLESS THE FEEDER FAULT LIGHT HAS FAILED. A GOOD BUS WILL NEVER BE CROSSTIED INTO A SHORT OR POSSIBLE SHORT.
	22-14	THE INVERTERS WILL BE SWITCHED FOR A VOLTAGE LESS THAN OR EQUAL TO 112 VAC OR A FREQUENCY GREATER THAN OR EQUAL TO 402 OR LESS THAN OR EQUAL TO 398 HZ.

R	ITEM	
	22-15	BATTERY MANAGEMENT WILL BE PERFORMED ONLY DURING LUNAR STAY PERIODS AND THEN ONLY IF IT CAN PREVENT VIOLATION OF CONSUMABLE REDLINES DUE TO LOSS OF A SINGLE DESCENT BATTERY.
	22-16	FOR A SHORTED DESCENT FEEDER, THE ASCENT BATTERIES WILL BE PLACED ON NORMAL FEED WITH THE SHORT ISOLATED VIA THE DEADFACE RELAY. OPERATIONALLY THIS RESULTS IN THE LOSS OF ALL REMAINING DESCENT ELECTRICAL ENERGY FOR CONSUMABLE CONSIDERATIONS. THE TWO DESCENT BATTERIES THAT STILL HAVE AN OPERABLE FEED PATH WILL BE USED ONLY IF NECESSARY TO MAINTAIN CREW SAFETY.
	22-17	IF AN ASCENT BATTERY IS LOST AT ANY TIME EXCEPT DURING POWERED DESCENT, THE REMAINING ASCENT BATTERY WILL BE USED AT THE REQUIRED TIME BY PLACING THE BATTERY ON ITS NORMAL AND BACKUP FEEDPATHS WITH THE BUS CROSS-TIE (100A) CB'S CLOSED. PRIOR TO PRESSING THE ABORT STAGE BUTTON, THE DESCENT BATTERIES MUST BE TURNED OFF AND THE DES ECA CB'S (2) MUST BE OPENED. DURING POWERED DESCENT THE REMAINING ASCENT BATTERY WILL BE USED ONLY ON ITS NORMAL FEEDPATH AND WITH THE CROSS-TIE CB'S OPEN. SHOULD THERE BE AN ABORT STAGE DURING POWERED DESCENT AFTER ONE ASCENT BATTERY HAS FAILED, THE ASSOCIATED BUS WILL BE LOST AT STAGING.
	22-18	FOR AN OPEN DESCENT FEEDER OR FOR THE LOSS OF TWO DESCENT BATTERIES ON THE SAME BUS THE CROSS TIE BAL LOAD CIRCUIT BREAKERS WILL BE CLOSED ON THE LUNAR SURFACE AND THE MISSION CONTINUED WITHIN THE CONSUMMABLES BUDGET.
	22-19	FOR A SHORTED ASCENT FEEDER ON THE LUNAR SURFACE, THE ASCENT BATTERIES WILL NOT BE CONNECTED UNTIL THE NOMINAL TIME TO MEET PRECONDITIONING REQUIREMENTS.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC	
	22-20	LOSS OF EITHER DC BUS			REF MALF PROC EPS---
			ALL	A. DELAY STAGING ALAP	1 UNSTAGED DC BUS
			DOCKED	B. CONTINUE MISSION	2 STAGED DC BUS
				1. DO NOT UNDOCK	
				2. CREWMEN OPERATE WITH CONNECTING HATCHES OPEN AND TUNNEL CLEAR	• LOSS OF DC BUS RESULTS IN LOSS OF ONE PYRO SYSTEM
				3. PERFORM LIMITED SYSTEMS EVALUATION	• LOSS OF EITHER DC BUS DURING DESCENT ENGINE BURNS RESULTS IN THROTTLING TO 100 PERCENT. IF ON INV 2, LOSS OF THE LMP BUS CAUSES THE ENG TO SHUT DOWN.
			UNDOCKED	C. DOCK ASAP/ NO GO CIRC	
			PRE-PDI	D. NO GO PDI/DOCK ASAP	
			POWERED DESCENT	E. ABORT DOCK ASAP	
			LUNAR STAY	F. LIFTOFF AT NEXT BEST OPPORTUNITY	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	22-21	SHORTED DC BUS FEEDER			REF MALF PROC EPS---
					1 UNSTAGED DC BUS
		A. DESCENT	ALL	A.1. CONTINUE MISSION	2 STAGED DC BUS
			UNDOCKED	2. NO GO CIRC/DOCK ASAP	• SEE MANAGEMENT RULE 22-16
			PRE-PDI	3. DOCK ASAP	
			POWERED DESCENT	4. ABORT DOCK ASAP	
			LUNAR STAY	5. LIFTOFF AT NEXT BEST OPPORTUNITY	
		B. ASCENT	ALL	B.1. DELAY STAGING ALAP	• SEE MANAGEMENT RULE 22-19
			DOCKED	2. CONTINUE MISSION	
				(A) DO NOT UNDOCK	
				(B) CREWMEN OPERATE WITH CONNECTING HATCHES OPEN AND TUNNEL CLEAR	
				(C) PERFORM LIMITED SYSTEMS EVALUATION	
			UNDOCKED	3. DOCK ASAP/NO GO CIRC	
			PRE-PDI	4. NO GO PDI DOCK ASAP	
			POWERED DESCENT	5. ABORT DOCK ASAP	
			LUNAR STAY	6. LIFTOFF AT NEXT BEST OPPORTUNITY	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	22-22	LOSS OF ASCENT BATTERY(S)			REF MALF PROC EPS--- 2 STAGED DC BUS 4 STAGED BATTERY
		A. LOSS OF ONE ASCENT BATTERY	DOCKED UNDOCKED	A. 1. CONTINUE MISSION NO GO CIRC DO NOT STAGE UNLESS DESCENT BATTERIES AND O2 ARE DEPLETED	
			PRE-PDI	2. RETURN TO VICINITY OF CSM ASAP NO GO PDI DO NOT STAGE UNLESS DESCENT BATTERIES AND O2 ARE DEPLETED	
			POWERED DESCENT	3.(A) PDI TO PDI + 5+30 - ABORT DELAY STAGING ALAP (B) PDI + 5+30 TO TD - CONTINUE MISSION	
			LUNAR STAY	4. LIFTOFF AT NEXT BEST OPPORTUNITY	
		B. LOSS OF TWO ASCENT BATTERIES	ALL	B. 1. DO NOT STAGE DO NOT UNDOCK DOCK ASAP IF UNDOCKED	NOTE--- THIS RULE DOES NOT APPLY AFTER PDI + 5+30

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	22-23	LOSS OF DESCENT BATTERY(S)			REF MALF PROC EPS---
		A. LOSS OF ONE DESCENT BATTERY	ALL	A. CONTINUE MISSION	1 UNSTAGED DC BUS 5 UNSTAGED BAT TB ABNORMAL
		B. LOSS OF TWO DESCENT BATTERIES	ALL	B. CONTINUE MISSION	NOTE--- SEE MANAGEMENT RULE 22-18. CONSUMABLES DICTATE GO/NO GO FOR REMAINING MISSION PHASES.
		C. LOSS OF THREE OR MORE DESCENT BATTERIES	DOCKED	C. 1. DO NOT UNDOCK OPERATE WITH CONNECTING HATCHES OPEN AND TUNNEL CLEAR	
			UNDOCKED	2. DOCK ASAP, NO GO CIRC	
			PRE-PDI	3. NO GO PDI DOCK ASAP	
			POWERED DESCENT	4. (A) PDI TO LO GATE - ABORT DOCK ASAP	
				(B) LO GATE TO TD - CONTINUE MISSION	
			LUNAR STAY	5. LIFT OFF AT NEXT BEST OPPORTUNITY	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	22-24	LOSS OF INVERTER(S)			REF MALF PROC EPS---
		A. LOSS OF ONE INVERTER	ALL	A. 1. CONTINUE MISSION	6 INVERTER
		B. LOSS OF BOTH INVERTERS	DOCKED UNDOCKED	B. 1. CONTINUE MISSION NO GO CIRC	• LOSS OF AC POWER RESULTS IN LOSS OF DPS GIMBALS, RR, S-BND STEERABLE ANT (HBR TM), BOTH FDAI SPHERES, • HBR TM IS AVAILABLE FROM AN OMNI ANTENNA AND A 210 FT. MSFN SITE.
			PRE-PDI	2. DO NOT PERFORM PDI	
			POWERED DESCENT	3.(A) PDI TO LO GATE - ABORT	
				(B) LO GATE TO TD - CONTINUE MISSION	
			LUNAR STAY	4. CONTINUE MISSION	
	22-25	LOSS OF AC BUSES			REF MALF PROC EPS---
		A. LOSS OF BUS A	DOCKED UNDOCKED	A. 1. CONTINUE MISSION NO GO CIRC	6 INVERTER LOSS OF AC BUS A RESULTS IN LOSS OF DPS GIMBAL CONTROL, RENDZ RADAR, AND INTEGRAL LIGHTING
			PRE-PDI POWERED DESCENT/ LUNAR STAY	2. CONTINUE MISSION	LOSS OF AC BUS B RESULTS IN LOSS OF S-BAND STEERABLE ANTENNA (HBR TM) AND NUMERIC LIGHTING, HBR TM IS AVAILABLE FROM AN OMNI ANTENNA AND A 210 FT MSFN SITE.
		B. LOSS OF BUS B	ALL	B. CONTINUE MISSION	LOSS OF BOTH AC BUSES RESULTS IN THE ABOVE PLUS LOSS OF BOTH FDAI SPHERES AND THE AOT
		C. LOSS OF BOTH BUS A AND B	DOCKED/ UNDOCKED	C.1. CONTINUE MISSION- NO GO CIRC	
			PRE-PDI	2. DO NOT PERFORM PDI	
			POWERED DESCENT	3.(A) PDI TO LO GATE- ABORT	
				(B) LO GATE TO TD - CONTINUE MISSION	
			LUNAR STAY	4. CONTINUE MISSION	
		RULE NUMBERS 22-26 THROUGH 22-49 ARE RESERVED.			

R | ITEM

' INSTRUMENTATION REQUIREMENTS '

22-50

MEAS DESCRIPTION	PCM	ONBOARD	CATEGORY	MISSION RULE REFERENCE
AC BUS FREQ	GC0155F	CAUT	1 OF 2	22-2,5,24,25
AC BUS VOLTS	GC0071V	METER, CAUT	M	
BAT 1 CUR	GC1201C	METER	1 OF 2	
BAT 2 CUR	GC1202C	METER	M PCM	
LMP BUS VOLTS	GC0302V	METER,CAUT	2 OF 3	
BAT 1 VOLTS	GC0201V	METER	M	
BAT 2 VOLTS	GC0202V	METER		22-2,10,14,20,21,22,23
BAT 5 VOLTS	GC0205V	METER		
BAT 3 CUR	GC1203C	METER	1 OF 2	
BAT 4 CUR	GC1204C	METER	M PCM	
CDR BUS VOLTS	GC0301V	METER,CAUT	2 OF 3	
BAT 3 VOLTS	GC0203V	METER	M	
BAT 4 VOLTS	GC0204V	METER		
BAT 6 VOLTS	GC0206V	METER		
BAT 5 CUR	GC1205C	METER	M PCM	
BAT 6 CUR	GC1206C	METER	M PCM	
BAT 1 MAL	GC9961U	CAUT, COMP	HD	
BAT 2 MAL	GC9962U	CAUT, COMP	HD	22-2,10,14,20,21,23
BAT 3 MAL	GC9963U	CAUT, COMP	HD	
BAT 4 MAL	GC9964U	CAUT, COMP	HD	
			HD	
BAT 6 MAL	GC9966U	CAUT, COMP	HD	22-2,10,20,21,22,23
BATTERY MAL	GL4047X	COMP	HD	
BAT 1 LOW TAP	GC4362X	FLAG	HD	
BAT 2 LOW TAP	GC4364X	FLAG	HD	22-2,10,20,21,23
BAT 3 LOW TAP	GC4365X	FLAG	HD	
BAT 4 LOW TAP	GC4368X	FLAG	HD	
BAT 5 B/U CDR	GC4369X	FLAG	HD	
BAT 6 NORM CDR	GC4370X	FLAG	HD	22-2,10,17,20,21,22
BAT 5 NORM LMP	GC4371X	FLAG	HD	
BAT 6 B/U LMP	GC4372X	FLAG	HD	

NOTE--- LOSS OF SEVERAL OF THE HD MEASUREMENTS ABOVE WILL CAUSE SEVERELY DEGRADED MISSION MONITORING CAPABILITY.

R	ITEM	
		' GENERAL '
	23-1	TO INITIATE THE MANNED LM PHASES THE ENVIRONMENTAL CONTROL SYSTEM MUST PROVIDE THE FOLLOWING MINIMUM CAPABILITIES---

NOTE
LM ACTIVE RENDEZVOUS/CONTINGENCY
RETURN IS ASSUMED

A. DOCKED WITH HATCH OPEN AND TUNNEL CLEAR

1. COMBINED VEHICLE PRESSURE INTEGRITY

2. ONE LM COOLANT LOOP

B. DOCKED WITH HATCH CLOSED

1. CABIN PRESSURE INTEGRITY

2. SUIT LOOP INTEGRITY

3. ONE SUIT FAN

4. ONE COOLANT LOOP

5. SUFFICIENT O_2, H_2O, AND LIOH CONSUMABLES TO COMPLETE THE PLANNED ACTIVITY PERIOD PLUS A RESERVE OF 1 HOUR

C. UNDOCKED/SEPARATION AND SUBSEQUENT PHASES SEE LM TELMU GO/NO GO CRITERIA - PAGE 3-18.

R	ITEM	
	23-2	DEFINITIONS--- LOSS OF CABIN INTEGRITY LM PRESSURE VESSEL LEAKAGE SUCH THAT CABIN PRESSURE CANNOT BE MAINTAINED GREATER THAN OR EQUAL TO 4.6 PSIA WITH AN O2 FLOW RATE OF 0.6 LBS/HR. FOR DOCKED ACTIVITIES THIS WILL BE RELAXED TO A FLOW RATE OF 6 LBS/HR. LOSS OF SUIT LOOP INTEGRITY TOTAL PGA/SUIT LOOP LEAKAGE GREATER THAN OR EQUAL TO 0.3 PSI/MIN (0.6 LBS/HR) DURING SUIT LOOP PRESSURE CHECK OR A VISABLE TEAR IN THE PGA. LOSS OF COOLANT LOOP A. SUSTAINED GLYCOL TEMPERATURE GREATER THAN OR EQUAL TO 50 DEGREE F AND RISING EXCEPT DURING COOLANT LOOP STARTUP AND DRYOUT (SUBLIMATOR LOST). B. GLYCOL PUMP DELTA P LESS THAN OR EQUAL TO 6 PSID (CIRCULATION LOST) OR KNOWN LOSS OF H2O FEED CAPABILITY TO THE SUBLIMATOR(S). GLYCOL COOLANT LEAK OBSERVED FLUID IN CABIN CONFIRMED BY TASTE OR PRESENCE OF GLYCOL LOW INDICATION CONFIRMED BY STATIC PRESSURE DROP. LOSS OF DESCENT O2 TANK INABILITY TO TRANSFER O2 FROM DESCENT TANK OR MSFN CONFIRMATION OF INADEQUATE DESCENT TANK PRESSURE WITH O2 MANIFOLD PRESSURE. LOSS OF ASCENT O2 TANK A. MSFN CONFIRMATION OF LOSS OF ASCENT TANK PRESSURE WITH O2 MANIFOLD PRESSURE-- OR B. IF O2 MANIFOLD PRESSURE CANNOT BE READ, AND VEHICLE IS UNSTAGED AND DESCENT O2 TANK GREATER THAN 35 PERCENT, CREW MAY CONFIRM LOSS BY BALANCING ONE TANK AGAINST THE OTHER, WITH MSFN COVERAGE--- OR C. IF STAGED OR IF DESCENT O2 LESS THAN 35 PERCENT, LOSS OF ONBOARD AND MSFN READOUT. LOSS OF DESCENT H2O TANK A. MSFN CONFIRMATION OF LOSS OF DESCENT TANK PRESSURE WITH DES H2O P AND H2O DELTA P. B. INABILITY TO SUPPLY H2O TO W/B RESULTING IN RISING GLYCOL AND SUIT LOOP TEMPERATURE (CREW AND MSFN) AND DROP IN H2O DELTA P (MSFN ONLY). LOSS OF ASCENT H2O TANK A. LOSS OF MEASUREMENT AND REMAINING TANK FEEDING AT TWICE NORMAL RATE. B. ONE TANK FEEDING TWICE NORMAL RATE AND NO CHANGE IN MEASUREMENT ON OTHER TANK.
	23-3	IF A SUBLIMATOR IS LOST DUE TO BREAKTHROUGH, NO RESTART ATTEMPT WILL BE MADE.
	23-4	OXYGEN PURGE SYSTEM AND PLSS CONSUMABLES WILL BE RESERVED FOR POSSIBLE EVT AND WILL NOT BE CONSIDERED FOR LM GO/NO-GO'S OR REDLINES.
	23-5	TWO POUNDS OF OXYGEN CONTAINED IN THE LM CABIN WILL BE CONSIDERED AVAILABLE IN CALCULATING GO/NO-GO'S OR REDLINES. THE CABIN CAN BE CONSIDERED, WHEN DISCUSSING FUNCTIONAL PRESSURE VESSEL REQUIREMENTS, AS A BACKUP TO THE ASCENT O2 TANKS.
	23-6	ANY SPECIFIC MISSION RULES REQUIRING A NEXT BEST OPPORTUNITY LIFTOFF WILL BE CAUSE FOR TERMINATION OF AN EVA. ADDITIONALLY, A CREWMAN WILL BE REQUIRED TO RETURN FROM AN EVA TO CORRECT A FAILED OPEN DEMAND REGULATOR.
		RULE NUMBERS 23-7 THROUGH 23-10 ARE RESERVED.

R	ITEM	
		' SYSTEMS MANAGEMENT '
	23-11	IF EITHER ASCENT O2 TANK IS LESS THAN OR EQUAL TO 95 PERCENT, IT WILL BE REPLENISHED FROM THE DESCENT O2 WHEN THE DESCENT TANK QUANTITY IS GREATER THAN OR EQUAL TO 35 PERCENT AND AS CLOSE TO STAGING AS POSSIBLE.
	23-12	THE PLSS FILL VALVE WILL BE CLOSED, EXCEPT FOR REPRESSURIZING THE PLSS AND FOR MSFN REQUESTED READOUTS OF O2 MANIFOLD PRESSURE.
	23-13	CREW WILL GO TO EGRESS MODE IF INSUFFICIENT O2 IS AVAILABLE TO MAINTAIN CABIN PRESSURE FOR THE REQUIRED TIME. ADDITIONALLY, A MISSION PHASE WILL NOT BE INITIATED IF THIS CONDITION CAN BE ANTICIPATED.
		RULE NUMBERS 23-14 THROUGH 23-19 ARE RESERVED.

SPECIFIC MISSION RULES

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	23-20	LOSS OF SUIT LOOP INTEGRITY	DOCKED	CONTINUE MISSION 1. PERFORM SYSTEMS EVALUATION WITHIN CONSUMABLES LIFETIME CONSTRAINTS WITH HATCH OPEN AND TUNNEL CLEAR 2. NO-GO FOR UNDOCKING	• REF MALF PROC ECS--- 4A SUIT/FAN
			UNDOCKED	DOCK ASAP DO NOT STAGE WHILE UNDOCKED NO-GO FOR CIRC	
			PRE-PDI	DOCK ASAP DO NOT STAGE WHILE UNDOCKED	
			POWERED DESCENT	1. PDI TO PDI +5+30 - ABORT DOCK ASAP DO NOT STAGE WHILE UNDOCKED 2. PDI +5+30 TO TD - ABORT DOCK ASAP	
			LUNAR STAY	LIFTOFF AT NEXT BEST OPPORTUNITY	
			RNDZ	CONTINUE MISSION DOCK ASAP	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	23-21	LOSS OF CABIN PRESSURE INTEGRITY			• REF MALF PROC ECS--- 2A CABIN
			DOCKED	CONTINUE MISSION 1. PERFORM SYSTEMS EVALUATION WITHIN CONSUMABLES LIFETIME CONSTRAINTS WITH ONE CREWMAN ON THE CSM UMBILICALS 2. NO-GO FOR UNDOCKING	
			UNDOCKED	DOCK ASAP DO NOT STAGE WHILE UNDOCKED NO-GO FOR CIRC	
			PRE-PDI	DOCK ASAP DO NOT STAGE WHILE UNDOCKED NO-GO FOR PDI	
			POWERED DESCENT	1. PDI TO PDI +5+30 - ABORT DOCK ASAP DO NOT STAGE WHILE UNDOCKED 2. PDI +5+30 TO LO GATE - ABORT DOCK ASAP 3. LO GATE TO TD - CONTINUE MISSION	
			LUNAR STAY	LIFTOFF AT NEXT BEST OPPORTUNITY	
			RNDZ	CONTINUE MISSION DOCK ASAP	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	23-22	SUIT FAN(S) FAILURE			• REF MALF PROC ECS---
		A. ONE SUIT FAN	ALL	A.1. CONTINUE MISSION	7A ECS
		B. TWO SUIT FANS	DOCKED	B.1. CONTINUE MISSION WITH TUNNEL CLEAR AND ON TRANSFER UMBILICAL OR CW GARMENT W/O SUIT	B. REMOVE HELMET AND GLOVES • REF MALF PROC ECS---
				NO-GO FOR UNDOCKING	4 SUIT FAN
			UNDOCKED	2. DOCK ASAP	
				DO NOT STAGE WHILE UNDOCKED	
				NO-GO FOR CIRC	
			PRE-PDI	3. DOCK ASAP	
				DO NOT STAGE WHILE UNDOCKED	
				NO GO FOR PDI	
			POWERED DESCENT	4.(A) PDI TO PDI + 5+30 ABORT	PLACE DEMAND REG B TO "DIRECT O2" IMMEDIATELY OR REMOVE HELMETS (MUST BE REMOVED FOR STAGING.)
				DOCK ASAP	
				DO NOT STAGE WHILE UNDOCKED	
				(B) PDI + 5+30 TO LO GATE ABORT	
				(C) LO GATE TO TD CONTINUE MISSION	
			LUNAR STAY	5. LIFTOFF AT NEXT BEST OPPORTUNITY	RETAIN PLSS'S FOR ASCENT IF POSSIBLE.
			RNDZ	6. DOCK ASAP	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	23-23	DEMAND REGULATOR(S) FAIL OPEN OR CLOSED			• REF MALF PROC ECS---
					3 CABIN PRESS IND HI
		A. ONE REGULATOR	ALL	A. CONTINUE MISSION	5 SUIT PRESS HI
					6 02 QTY
		B. TWO REGULATORS	DOCKED/ UNDOCKED/	B.1. CONTINUE MISSION DO NOT UNDOCK NO GO CIRC	
			PRE-PDI	2. NO GO PDI	
			POWERED DESCENT	3. CONTINUE MISSION	
			LUNAR STAY	4. DO NOT DEPRESS CABIN LUNAR STAY MAY BE CONTINUED WITHIN CONSUMABLES BUDGET	
			RNDZ	5. CONTINUE MISSION	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	23-24	LOSS OF H2O SEPARATOR(S)			• REF MALF PROC ECS--- 7B ECS
		A. ONE H2O SEPARATOR	ALL	A. CONTINUE MISSION	
		B. TWO H2O SEPARATORS	DOCKED	B.1. CONTINUE MISSION	
			UNDOCKED PRE-PDI	2. DOCK ASAP NO GO PDI DO NOT STAGE WHILE UNDOCKED	
			POWERED DESCENT	3. CONTINUE MISSION	
			LUNAR STAY	4. LIFTOFF NEXT BEST OPPORTUNITY	
			RNDZ	5. CONTINUE MISSION AND DOCK ASAP	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	23-25	LOSS OF O2 TANK(S)			
		A. ONE ASCENT TANK	ALL	A. CONTINUE MISSION	
		B. TWO ASCENT TANKS	DOCKED	B.1. DO NOT UNDOCK	
			UNDOCKED PRE-PDI	2. DOCK ASAP NO GO CIRC NO GO PDI DELAY STAGING ALAP	
			POWERED DESCENT	3.(A) PDI TO PDI + 5+30 ABORT DELAY STAGING ALAP	
				(B) PDI + 5+30 TO LO GATE ABORT	
				(C) LO GATE TO TOUCHDOWN CONTINUE MISSION	
			LUNAR STAY	4. STAY WITHOUT EVA	
			RNDZ	5. CONTINUE MISSION	
		C. DESCENT TANK	DOCKED	C.1. CONTINUE MISSION	
			UNDOCKED/ PRE-PDI	2. DOCK ASAP NO GO CIRC NO GO PDI	
			POWERED DESCENT	3. CONTINUE MISSION	
			LUNAR STAY	4. LIFTOFF NEXT BEST OPPORTUNITY	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	23-26	LOSS OF COOLANT LOOP(S)			• REF MALF PROC ECS---
		A. PRIMARY LOOP OR SECONDARY LOOP	DOCKED UNDOCKED	A. 1. CONTINUE MISSION ON SECONDARY LOOP NO-GO FOR CIRC	7E ECS -GLYCOL 9 GLYCOL 10 GLYCOL PRESS LOW
			PRE-PDI	2. RETURN TO VICINITY OF CSM NO-GO FOR PDI	
			POWERED DESCENT	3. CONTINUE MISSION ON SECONDARY LOOP	
			LUNAR STAY	4. LIFTOFF NEXT BEST OPPORTUNITY.	
				FOR LOSS OF PRIMARY LOOP--- (A) OPEN CB (II) IMU OPR (B) AT LIFTOFF- 60 MIN, CLOSE CB (II) IMU OPR AND CONTINUE MISSION	
			RNDZ	5. CONTINUE MISSION	
		B. BOTH LOOPS (ANY COMBINATION OF LOSS OF CIRCULATION, SUBLIMATION CAPABILITY, OR H2O FEED FOR BOTH LOOPS)	DOCKED	B. 1. INGRESS CSM ASAP NO-GO FOR UNDOCKING	
			UNDOCKED	2. DOCK ASAP	
			PRE-PDI	3. NO GO CIRC DO NOT STAGE, NO GO PDI	
			POWERED DESCENT	4.(A) PDI TO PDI + 5+30 ABORT DOCK ASAP DO NOT STAGE (B) PDI + 5+30 TO LO-GATE- ABORT DOCK ASAP (C) LO-GATE TO TD - CONTINUE MISSION	B.4.(C) LIFT OFF IMMEDIATELY AFTER TOUCHDOWN.
			LUNAR STAY	4. LIFTOFF NEXT BEST OPPORTUNITY	
			RNDZ	5. CONTINUE MISSION	B.5. CREW MAY ELECT TO REMOVE PGA'S FOR COOLING.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	23-27	LOSS OF PRIMARY H2O FEEDPATH	DOCKED UNDOCKED	CONTINUE MISSION	• REF MALF PROC ECS---
				NO-GO FOR UNDOCKING NO GO FOR CIRC	8 GLYCOL
			PRE-PDI	RETURN TO VICINITY OF CSM	
			POWERED DESCENT	CONTINUE MISSION	
			LUNAR STAY	LIFTOFF NEXT BEST OPPORTUNITY	
			RNDZ	CONTINUE MISSION	
	23-28	LOSS OF H2O TANK(S)			
		A. ONE ASCENT TANK	ALL	A. CONTINUE MISSION	
		B. TWO ASCENT TANKS	DOCKED UNDOCKED	B.1. CONTINUE MISSION NO GO CIRC	
			PRE-PDI	2. RETURN TO VICINITY OF CSM ASAP DO NOT STAGE NO GO PDI	
			POWERED DESCENT	3.(A) PDI TO PDI + 5+30 ABORT DO NOT STAGE (B) PDI + 5+30 TO LO-GATE ABORT (C) LO GATE TO TOUCHDOWN CONTINUE MISSION	
			LUNAR STAY	4. LIFTOFF NEXT BEST OPPORTUNITY	
			RNDZ	5. CONTINUE MISSION	CREW MAY ELECT TO REMOVE PGA'S FOR COOLING.
		C. DESCENT TANK	DOCKED	C.1. CONTINUE MISSION	
			UNDOCKED/ PRE-PDI	2. NO GO CIRC NO GO PDI	
			POWERED DESCENT/ LUNAR STAY	3. CONTINUE MISSION WITH ASCENT CONSUMABLES CAPABILITY	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	23-29	FIRE OR SMOKE IN CABIN OR SUIT	ALL	TROUBLESHOOT/COMBAT FIRE ASSESS DAMAGE AND TRANSFER TO CSM IF NECESSARY	REF AOH PROC 5.3.2
	23-30	CONTAMINATION IN CABIN	ALL	CREW MAY ELECT TO DECOMPRESS	IF UNABLE TO CLEAR CONTAMINATION, MISSION MAY BE TERMINATED EARLY.
	23-31	GLYCOL COOLANT LEAK	ALL	TRANSFER TO CSM	REF MALF PROC ECS---
		A. CABIN	ALL	A. PURGE SUIT WITH DIRECT O2	8 GLYCOL
		B. SUIT	ALL	B. DISCONNECT FROM SUIT LOOP	
		RULE NUMBERS 23-32 THROUGH 23-49 ARE RESERVED.			

R	ITEM	MEAS DESCRIPTION	INSTRUMENTATION REQUIREMENTS PCM	ONBOARD	CATEGORY	MISSION RULE REF
	23-50	SUIT PRESS	GF1301P	METER	HD	23-1,2,6,20,21,23
				WARNING	HD	
		CABIN PRESS	GF3571P	METER	1 OF 3	
		U/H RLF PRESS	GF3591P	-----	M	23-1,2,5,13,20,21,
		F/H RLF PRESS	GF3592P	-----		23,29
		DES O2 PRESS	GF3584P	METER, CAUT	1 OF 2	
		O2 MFLD PRESS	GF3589P	----------	M	23-1,2,6,11,12,13,
		ASC 1 O2 PRESS	GF3582P	METER, CAUT	1 OF 3	21,23,25
		ASC 2 O2 PRESS	GF3583P	METER, CAUT	M	
		GLYCOL PUMP DELTA P	GF2021P	-----		
		SEC GLYCOL PUMP PRESS	GF2921P	-----	1 OF 2	
		GLYCOL PUMP PRESS	GF9997U	METER	M	23-1,2,3,6,26,31
		SEL GLYCOL LVL LOW	GF9986U	CAUT		
		GLYCOL TEMP	GF9998U	METER, CAUT	1 OF 2	23-1,2,3,6,26,31
		GLYCOL OUTLET TEMP	GF2581T	----------	M	
		SUIT TEMP	GF1281T	METER		
		GLYCOL INLET TEMP	GF2531T	-----		
		DES H2O QTY	GF4581Q	METER, CAUT	1 OF 2	
		DES H2O PRESS	GF4501P	----------	M	23-1,2,27,28
		ASC 1 H2O QTY	GF4582Q	METER, CAUT	1 OF 2	
		ASC 2 H2O QTY	GF4583Q	METER, CAUT	M	
		PRI H2O REG DELTA P	GF4101P	----------	HD	23-1,2,27,28
		RTG TEMP	GL8275T	----------	HD	
		REPR ELEC OPEN	GF3572X	WARNING	HD	23-1,2,5,13,20,21,23,
		CO2 PART PRESS	GF1521P	METER, CAUT, COMP	HD	23-1,24,30
		H2O SEP RATE	GF9999U	CAUT, COMP	HD	23-1,22,24
		SUIT DIV EGRESS	GF1221X	----------	HD	23-1,20,21,22,29

R | ITEM

' GENERAL '

24-1 RESERVED

24-2 DEFINITIONS

3-AXIS ATTITUDE CONTROL

3-AXIS ATTITUDE CONTROL IS DEFINED AS THE ABILITY TO CHANGE THE EXISTING VEHICLE ATTIUDE PLUS AND MINUS ABOUT EACH AXIS. TO HAVE THIS CAPABILITY THE LM REQUIRES AND OPERATIONAL MANUAL OR AUTOMATIC CONTROL SYSTEM.

REDUNDANT 3-AXIS ATTITUDE CONTROL

REDUNDANT 3-AXIS ATTITUDE CONTROL IS DEFINED AS HAVING TWU AUTONOMOUS ATTITUDE CONTROL SYSTEMS INDEPENDENT OF SECONDARY COILS, I.E., NO SINGLE FAILURE WILL CAUSE LOSS OF BOTH AUTONOMOUS SYTEMS.

GUIDANCE STEERING

GUIDANCE STEERING IS DEFINED AS THE ABILITY TO CALCULATE AND STEER LM ALONG THE DESIRED THRUST VECTOR DURING A POWERED MANEUVER. TO HAVE THIS CAPABILITY THE LM REQUIRES AN OPERATIONAL PGNS OR AGS.

OPERATIONAL PGNS

AN OPERATIONAL PGNS IS DEFINED AS NO LGC FAILURE, NO ISS FAILURE, NO DSKY FAILURES, AND NO CES FAILURES PREVENTING ATTITUDE CONTROL.

A. ANY FAILURE OF THE LGC HARDWARE AND/OR THE ASSOCIATED INPUT/OUTPUT INTERFACES WHICH CANNOT BE REMEDIED BY CREW PROCEDURES IS CONSIDERED AN LGC FAILURE.

B. ANY FAILURE WITHIN THE IMU, CDU, PTA, OR THE PSA WHICH WOULD CAUSE A PERMANENT LOSS OF THE INERTIAL ATTITUDE AND/OR VELOCITY MEASUREMENT, IS CONSIDERED AN ISS FAILURE.

C. ANY FAILURE OF THE DSKY HARDWARE AND/OR THE ASSOCIATED INPUT/OUTPUT INTERFACES WHICH CANNOT BE REMEDIED BY CREW PROCEDURES IS CONSIDERED A DSKY FAILURE.

D. ANY FAILURE OF THE CES HARDWARE THAT PREVENTS ATTITUDE CONTROL WHILE IN PGNS IS CONSIDERED A CES FAILURE.

OPERATIONAL AGS

AN OPERATIONAL AGS IS DEFINED AS NO AEA FAILURE, NO ASA FAILURE, NO DEDA FAILURE, AND NO CES FAILURE PREVENTING AGS ATTITUDE CONTROL.

A. ANY FAILURE OF THE AEA HARDWARE AND/OR THE ASSOCIATED INPUT/OUTPUT INTERFACES WHICH CANNOT BE REMEDIED BY CREW PROCEDURES IS CONSIDERED AN AEA FAILURE.

B. ANY FAILURE OF THE ASA HARDWARE AND/OR THE ASSOCIATED INPUT/OUTPUT INTERFACES WHICH CAUSE LOSS OF THE VEHICLE ATTITUDE AND/OR VELOCITY MEASUREMENTS IS CONSIDERED AN ASA FAILURE.

C. ANY FAILURE OF THE DEDA HARDWARE AND/OR THE ASSOCIATED INPUT/OUTPUT INTERFACES WHICH CANNOT BE REMEDIED BY CREW PROCEDURES IS CONSIDERED A DEDA FAILURE.

D. ANY FAILURE OF THE CES HARDWARE THAT PREVENTS ATTITUDE CONTROL WHILE IN AGS IS CONSIDERED A CES FAILURE.

3-AXIS TRANSLATION

3-AXIS TRANSLATION IS DEFINED AS THE ABILITY TO CHANGE THE VEHICLE VELOCITY, PLUS OR MINUS, ALONG EACH BODY AXIS. TO HAVE THIS CAPABILITY THE LM REQUIRES ONE TTCA AND AN OPERATIONAL PGNS OR OPERATIONAL CES CIRCUITRY (AGS MANUAL).

R	ITEM	
		' MANAGEMENT '
	24-3	IMU
		A. IRIG BIAS UPDATES WILL BE ACCOMPLISHED WHEN GYRO DRIFT IS GREATER THAN OR EQUAL TO +/- .075 DEG/HR (5 MERU)
		B. THE PGNS WILL BE CONSIDERED NO-GO WITH A GYRO DRIFT GREATER THAN OR EQUAL TO +/-1.5 DEG/HR (100 MERU). THE MAXIMUM ALLOWABLE VALUE WITHIN THE LGC IS +/-1.93 DEG/HR (128 MERU).
		C. PIPA BIAS UPDATES WILL BE ACCOMPLISHED AS FOLLOWS---
		1. NO BIAS UPDATES WILL BE ACCOMPLISHED PRIOR TO 30 MIN OF IMU OPERATION.
		2. THE INITAL BIAS UPDATES WILL BE ACCOMPLISHED IF THE DELTA BIAS IS GREATER THAN OR EQUAL TO +/- 0.03 CM/SEC/SEC, AND SUBSEQUENT UPDATES WILL BE ACCOMPLISHED IF THE DELTA BIAS IS GREATER THAN OR EQUAL TO +/- 0.1 CM/SEC/SEC.
		3. PIPA BIAS WILL NOT BE UPDATED WHILE THE LM IS ON THE LUNAR SURFACE.
		D. PNGS NO-GO FOR PIPA BIAS--- THE PNGS WILL BE CONSIDERED NO-GO IF THE PIPA BIAS EXCEEDS +/- 5.06 CM/SEC / SEC (.166 FT/SEC / SEC). THE MAXIMUM LOAD VALUE WITHIN THE LGC IS +/- 12.5 CM/SEC / SEC.
	24-4	LGC
		A. A MASS UPDATE IS REQUIRED IF THE DIFFERENCE BETWEEN THE GROUND CALCULATION AND LGC VALUE IS MORE THAN 200 LBS.
		B. ALL +/-(U-V) JETS WILL BE INHIBITED VIA V65 DURING DOCKED DPS BURNS.
		C. DURING DOCKED MANEUVERS, ALL DPS GIMBAL TRIMMING MUST BE DONE AT GREATER THAN 35 PERCENT THROTTLE IN THE AUTO THROTTLE MODE. THE RECOMMENDED SETTING IS 40 PERCENT THROTTLE.
	24-5	RENDEZVOUS RADAR
		A. THE RR MUST NOT BE USED TO TRACK CSM TRANSPONDER UNTIL 2 1/2 HOURS AFTER OPERATE HEATER ACTIVATION AND THE ANTENNA TEMPERATURE (HPM) IS GREATER THAN OR EQUAL TO 10 DEG.F AND THE GYRO PACKAGE IS ESTIMATED TO BE GREATER THAN OR EQUAL TO 15 DEG.F
		B. THE RR SHOULD NOT BE OPERATED AT AN ANTENNA TEMPERATURE GREATER THAN OR EQUAL TO 145 DEG F AND/OR A GYRO PACKAGE TEMP (ESTIMATED) OF GREATER THAN OR EQUAL TO 200 DEG F.
		C. IF IT IS ESTIMATED THAT THE RR GYRO PACKAGE WILL EXCEED 200 DEG F (HPM APPROX. 135 DEG F) PRIOR TO COMPLETION OF THE BRAKING PHASE, THE RR SHOULD BE TURNED OFF UNTIL REQUIRED FOR TPI AND BRAKING.
		D. IF THE ESTIMATED GYRO PACKAGE TEMP SHOULD EXCEED 200 DEG F (HPM APPROX. 135 DEG F) ANYTIME DURING THE BREAKING PHASE, THE AC POWER TO THE RR SHOULD NOT BE TURNED OFF.
		E. IF THE RR ANTENNA TEMP (HPM) EXCEEDS THE NOMINAL TEMP PROFILE BY 15 DEG F, THE RR SHOULD BE TURNED OFF IF IT IS NOT NEEDED.
		F. IF THE RR OVEN HEATERS ARE TURNED OFF (BOTH THE PGNS--- RNDZ RDR AND HEATERS---RNDZ RDR OPR OPEN) RR RANGE DATA MUST NOT BE USED UNTIL 17 MIN AFTER RE-ENERGIZING, ASSUMING THE OVEN TEMP HAS DROPPED TO THE COLD RAIL TEMP.

R	ITEM	
	24-6	LANDING RADAR A. THE LR SHOULD NOT NORMALLY BE OPERATED AT AN ANTENNA TEMP LESS THAN + 50 DEG F, HOWEVER, THE LUNAR LANDING MISSION WILL BE ATTEMPTED IF THE ANTENNA TEMP IS ABOVE THE CRITICAL LIMIT OF -15 DEG F (HARDWARE DAMAGE). B. LR ACTIVATION WILL BE DELAYED IF THE LR TEMP IS PREDICTED TO BE GREATER THAN 145 DEG. F AT PDI + 8+30 (HI GATE)
	24-7	AGS A. THE AGS IS DECLARED NO-GO DURING A GYRO AND ACCELEROMETER CALIBRATION IF THE GYRO DRIFT CHANGE IS GREATER THAN 2.00 DEG/HR AND IF THE ACCELEROMETER BIAS CHANGE IS GREATER THAN 0.039 FT/SEC/SEC FROM THE VALUE AT THE START OF THE CALIBRATION. B. THE AGS CAN BE USED TO PERFORM DOCKED ATTITUDE HOLD CONTROL. C. THE AGS IN PULSE MODE USING ONLY TTCA CONTROL CAN BE USED TO PERFORM A DOCKED BURN.
		RULE NUMBERS 24-8 THROUGH 24-19 ARE RESERVED.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC	
	24-2(	LOSS OF GUIDANCE STEERING			
		A. OPERATIONAL AGS	ALL	CONTINUE MISSION	• REF MALF PROC AGS--- 1 AGS WARNING LIGHT 2 DEDA RESPONSE IS ABNORMAL
		B. OPERATIONAL PGNS	DOCKED/ UNDOCKED	B.1.(A) RETURN TO CSM (B) NO-GO FOR CIRC	• REF MALF PROC PGNS--- 1 LGC WARN 2 ISS WARN 3 TEMP CAUTION 4 GIMBAL LOCK
			PRE-PDI	2.(A) RETURN TO CSM ASAP (B) NO-GO FOR PDI	
			POWERED DESCENT	3.(A) PRIOR TO HI GATE ABORT (B) AFTER HI GATE (1) LAND MANUALLY (2) NO-GO FOR EXTENDED LUNAR STAY IF FAILURE ALSO AFFECTS REDUNDANT 3-AXIS ATT CONTROL	
			LUNAR STAY	4. ASCEND AT NEXT BEST OPPORTUNITY IF FAILURE ALSO AFFECTS REDUNDANT 3-AXIS ATT CONTROL	
			RNDZ	5. CONTINUE MISSION	
	24-2.	LOSS OF FDAI FUNCTIONS (ATT, RATES, ERRORS)	ALL	CONTINUE MISSION CREW OPTION	
	24-2:	LOSS OF AOT	ALL	CONTINUE MISSION	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	24-23	LOSS OF RNDZ RADAR/ VHF RANGING/OPTICAL TRACKING			CSM OPTICAL TRACKING CAPABILITY REQUIRES THE LM TRACKING LIGHT AND THE ABILITY TO VISUALLY TRACK.
		A. LOSS OF ANY ONE	ALL	A.1. CONTINUE MISSION 2. REF. 3-81 FOR NAVIGATION AND TRACKING REQUIREMENTS FOR M=1 RNDZ	
		B. LOSS OF ANY TWO	DOCKED/ UNDOCKED	B.1.(A) RETURN TO CSM ASAP	
			PRE POI	(B) NO-GO FOR POI	
			ALL OTHER	2.(A) CONTINUE MISSION (B) REF 3-81 FOR NAVIGATION AND TRACKING REQUIREMENTS FOR M=1 RNDZ	
	24-24	LOSS OF LANDING RADAR	DOCKED/ UNDOCKED	1. RETURN TO CSM ASAP 2. NO-GO FOR CIRC	
			PRE-POI	1. RETURN TO CSM ASAP 2. NO-GO FOR POI	
			POWERED DESCENT	1. PRIOR TO ADEQUATE ALTITUDE UPDATING OF LM STATE VECTORS--- (A) NO-GO FOR LANDING (B) ABORT 2. AFTER ADEQUATE ALTITUDE UPDATING OF LM STATE VECTORS--- CONTINUE MISSION	1. GUIDO TO DECIDE WHEN ADEQUATE UPDATING OF LM STATE VECTORS HAS BEEN ACCOMPLISHED. REF MALF PROC PGNS--- 6 ALT LT 7 VEL LT REF MALF PROC HTRS--- 2 LR TEMP ABNORMAL
		RULES 24-25 THROUGH 24-27 ARE RESERVED			

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	24-28	LOSS OF REDUNDANT 3-AXIS ATTITUDE CONTROL	DOCKED/ UNDOCKED	1. A RETURN TO CSM ASAP	
				(B) NO-GO FOR CIRC	
			PRE-PDI	2.(A) RETURN TO CSM ASAP	
				(B) NO-GO FOR PDI	
			POWERED DESCENT	3.(A) PRIOR TO HI GATE ABORT	
				(B) AFTER HI GATE LANDING IS CREW OPTION	
			LUNAR STAY	4. ASCEND AT NEXT BEST OPPORTUNITY	
			RNDZ	5. CONTINUE MISSION	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	24-29	LOSS OF TRANSLATION CAPABILITY			
		A. AUTOMATIC ULLAGE (+X)	DOCKED/ UNDOCKED PRE-PDI	A.1. CONTINUE MISSION	A.1. CAN NOT DETECT FAILURE UNTIL LGC COMMANDS ULLAGE
			POWERED DESCENT	2.(A) PRIOR TO PDI	• REF MALF PROC CES--- 1 ABNORMAL VEHICLE DYNAMICS
				(1) BACK UP ULLAGE MANUALLY IF NECESSARY	6 TTCA CMDS ABNORMAL
				(2) PDI INHIBITED IF NO AUTO DPS START	
				(B) AFTER PDI CONTINUE MISSION	
		B. 3-AXIS TRANSLATION	DOCKED/ UNDOCKED	B.1.(A) RETURN TO CSM ASAP	
				(B) NO-GO FOR CIRC	
			PRE-PDI/ POWERED DESCENT/ LUNAR STAY	2. CONTINUE MISSION	
			RNDZ	3. NO-GO FOR LM ACTIVE DOCKING	B.3 X AXIS TRANSLATION REQUIRED FOR M=1 RNDZ

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	24-30	LOSS OF PITCH OR ROLL GDA	ALL	ENGINE GIMBAL - OFF CONTINUE MISSION UNLESS RCS IMPINGEMENT CONSTRAINTS ARE VIOLATED.	RCS IMPINGEMENT CONSTRAINTS ARE A FUNCTION OF THE GDA POSITION AT THE TIME OF FAILURE, SODB INFO WILL BE USED TO DETERMINE CAPABILITY TO COMPLETE DESCENT FOR A GIVEN GDA POSITION.
	24-31	LOSS OF REDUNDANT ASC ENG ON CAPABILITY	DOCKED/ UNDOCKED	1. RETURN TO CSM ASAP 2. NO-GO FOR CIRC	
			PRE-PDI	1. RETURN TO CSM ASAP 2. NO-GO FOR PDI	
			POWERED DESCENT	1. IF DPS INSERTION CAPABILITY EXISTS, ABORT 2. AFTER DPS INSERTION CAPABILITY CONTINUE MISSION 3. NO-GO FOR EXTENDED LUNAR STAY	
			LUNAR STAY	ASCEND AT NEXT BEST OPPORTUNITY	
	24-32	LOSS OF DPS AUTO ON CAPABILITY	DOCKED/ UNDOCKED	CONTINUE MISSION	• REF MALF PROC CES ---10
			PRE-PDI	CONTINUE MISSION	MPS DOES NOT THRUST WHEN EVENT TIMER IND ●0.00
			POWERED DESCENT	1. IF AUTOMATIC ULLAGE HAS OCCURRED--- A. ENG START PUSH B. DES ENG CMD OVRD ON 2. IF AUTOMATIC ULLAGE HAS NOT OCCURRED A. INHIBIT PDI IGNITION B. NO-GO FOR PDI	
		RULE NUMBER 24-33 IS RESERVED.			

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	24-34	LOSS OF AUTO THRUST CONTROL	ALL	CONTINUE MISSION	• REF MALF PROC CES--- 11 ENG THR AND CMD DO NOT AGREE/ OFF SCHEDULE•
	24-35	LOSS OF MANUAL THRUST CONTROL	ALL	CONTINUE MISSION	
	24-36	LOSS OF LUNAR CONTACT LIGHTS	POWERED DESCENT	CONTINUE MISSION	
		RULE NUMBER 24-37 THROUGH 24-39 ARE RESERVED			

PRELAUNCH INSTRUMENTATION

R	ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
	24-40	LGC DOWNLINK	GG0001U	-	-	M	24-20
		PLS TORO REF	GG1040V	-	-	HD	24-20
		2.5 VDC TM BIAS	GG1110V	-	-	HD	24-20
		IMU 28 VAC 800	GG1201V	-	-	HD	24-20
		IRIG SUSP 3.2 KC	GG1331V	-	-	HD	24-20
		IMU STBY	GG1513X	-	-	HD	24-20
		LGC OPR	GG1523X	-	-	HD	24-20
		X PIPA OUT IN PHASE	GG2001V	-	-	HD	24-20
		Y PIPA OUT IN PHASE	GG2021V	-	-	HD	24-20
		Z PIPA OUT IN PHASE	GG2041V	-	-	HD	24-20
		IG SVO ERR IN PHASE	GG2107V	-	-	HD	24-20
		IG IX RSVR OUT SIN	GG2112V	FDAI	COMMON	HD	24-20
		IG IX RXVR OUT COS	GG2113V	FDAI	COMMON	HD	24-20
		MG SVO ERR IN PHASE	GG2137V	-	-	HD	24-20
		MG IX RSVR OUT SIN	GG2142V	FDAI	COMMON	HD	24-20
		MG IX RSVR OUT COS	GG2143V	FDAI	COMMON	HD	24-20
		OG SVO ERR IN PHASE	GG2167V	-	-	HD	24-20
		OG RSVR OUT SIN	GG2172V	FDAI	COMMON	HD	24-20
		OG RSVR OUT COS	GG2173V	FDAI	COMMON	HD	24-20
		PITCH ATT ERR	GG2219V	FDAI	COMMON	HD - PCM	24-20
		YAW ATT ERR	GG2249V	FDAI	COMMON	HD - PCM	24-20
		ROLL ATT ERR	GG2279V	FDAI	COMMON	HD - PCM	24-20
		PIPA TEMP	GG2300T	C&W	SEPARATE	HD - PCM	24-20
		RR SHFT SIN	GG3304V	FDAI	COMMON	HD - PCM	24-23
		RR SHFT COS	GG3305V	FDAI	COMMON	HD - PCM	24-23
		RR TRUN SIN	GG3324V	FDAI	COMMON	HD - PCM	24-23
		RR TRUN COS	GG3325V	FDAI	COMMON	HD - PCM	24-23
		LGC WARNING	GG9001X	C&W	COMMON	HD - PCM	24-20
		ISS WARNING	GG9002X	C&W	COMMON	HD - PCM	24-20
		LR ANT TEMP	GN7563T	TEMP MONITOR	COMMON	HD - PCM	
		RR NO TRACK	GN7621X	C&W	COMMON	HD - PCM	24-23
		RR ANT TEMP	GN7723T	TEMP MONITOR	COMMON	HD - PCM	24-23
		YAW ERR CMD	GH1247V	-	-	M	24-28
		PITCH ERR CMD	GH1248V	-	-	M	24-28
		ROLL ERR CMD	GH1249V	-	-	M	24-28
		JD A4D OUTPUT	GH1419V	-	-	HD	24-27
		RCS TCP A4D	GR5032X	-	-	HD	24-27
		JD B3D OUTPUT	GH1423V	-	-	HD	24-27
		RCS TCP B3D	GR5036X	-	-	HD	24-27
		JD A2D OUTPUT	GH1427V	-	-	HD	24-27
		RCS TCP A2D	GR5040X	-	-	HD	24-27
		JD B1D OUTPUT	GH1431V	-	-	HD	24-27
		RCS TCP B1D	GR5044X	-	-	HD	24-27
		JD B4U OUTPUT	GH1418V	-	-	HD	24-27
		JD B4F OUTPUT	GH1420V	-	-	HD	24-27
		JD A4R OUTPUT	GH1421V	-	-	HD	24-27
		JD A3U OUTPUT	GH1422V	-	-	HD	24-27
		JD B3A OUTPUT	GH1424V	-	-	HD	24-27
		JD A3R OUTPUT	GH1425V	-	-	HD	24-27
		JD B2U OUTPUT	GH1426V	-	-	HD	24-27
		JD A2A OUTPUT	GH1428V	-	-	HD	24-27
		JD B2L OUTPUT	GH1429V	-	-	HD	24-27
		JD A1U OUTPUT	GH1430V	-	-	HD	24-27
		JD A1F OUTPUT	GH1432V	-	-	HD	24-27
		JD B1L OUTPUT	GH1433V	-	-	HD	24-27
		RCS TCP B4U	GR5031X	-	-	HD	24-27
		RCS TCP B4F	GR5033X	-	-	HD	24-27
		RCS TCO A4R	GR5034X	-	-	HD	24-27
		RCS TCP A3U	GR5035X	-	-	HD	24-27
		RCS TCP B3A	GR5037X	-	-	HD	24-27
		RCS TCP A3R	GR5038X	-	-	HD	24-27
		RCS TCP B2U	GR5039X	-	-	HD	24-27
		RCS TCP A2A	GR5041X	-	-	HD	24-27
		RCS TCP B2L	GR5042X	-	-	HD	24-27
		RCS TCP A1U	GR5043X	-	-	HD	24-27
		RCS TCP A1F	GR5045X	-	-	HD	24-27
		RCS TCP B1L	GR5046X	-	-	HD	24-27
		YAW ATT ERR	GH1455V	FDAI	COMMON	HD	24-28
		PITCH ATT ERR	GH1456V	FDAI	COMMON	HD	24-28

R	ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY		MISSION RULE REFERENCE
	24-40 CONT	ROLL ATT ERR	GH1457V	FDAI	COMMON	HD		24-28
		RGA YAW RATE	GH1461V	FDAI	COMMON	M	ON BOARD	24-28
		RGA PITCH RATE	GH1462V	FDAI	COMMON	M	PCM/HD	24-28
		RGA ROLL RATE	GH1463V	FDAI	COMMON	M		24-28
		AGS SEL	GH1621X	-	-	HD		24-33
		ROLL PLSD/DIR	GH1628X	-	-	HD		24-33
		PITCH PLSD/DIR	GH1629X	-	-	HD		24-33
		YAW PLSD/DIR	GH1630X	-	-	HD		24-33
		AUTO ON	GH1214X	-	-	HD		24-31
		APS ARM	GH1230X	-	-	M		24-31
		ENG FIRE OVRD	GH1286X	-	-	HD		24-31
		MAN THRUST CMD	GH1311V	METER	SEPARATE	M		24-34,24-35
		PITCH GDA POS	GH1313V	-	-	M		24-30
		ROLL GDA POS	GH1314V	-	-	M		24-30
		P TRM FAIL	GH1323X	C&W	COMMON	HD		24-30
		R TRM FAIL	GH1330X	C&W	COMMON	HD		24-30
		AUTO THRUST CMD	GH1331V	METER	SEPARATE	HD		24-34
		DPS ARM	GH1348X	-	-	HD		24-32,24-31
		VAR INJ ACT POS	GQ6806H	-	-	HD		24-34,24-35
		CES AC PWR FAIL	GL4026X	C&W	COMMON	HD		24-30
		CES DC PWR FAIL	GL4027X	C&W	COMMON	HD		24-30
		AGS DOWNLINK DATA	GI0001X	-	-	HD		24-33
		ASA TEMP	GI3301T	-	-	HD		24-33
		ASA PWR/AEA FAIL	GL4028X	C&W	COMMON	HD		24-33
		AUTO OFF	GH1217X	-	-	HD		24-32,24-31
		AGS AUTO	GH1641X	-	-	HD		24-27
		AGS ATT HOLD	GH1642X	-	-	HD		24-27
		PGNS AUTO	GH1643X	-	-	HD		24-27
		PGNS ATT HOLD	GH1644X	-	-	HD		24-27
		LR RNG DATA NO GOOD	GN7521X	C&W	COMMON	HD		
		LR VEL DATA NO GOOD	GN7557X	C&W	COMMON	HD		

R | ITEM

GENERAL

25-1 RESERVED

25-2 DEFINITIONS

A. AN OPERATIONAL DPS IS DEFINED AS FOLLOWS---

1. FUEL AND/OR OXID ENGINE INLET PRESSURE GREATER THAN 30 PSIA AT INITIATION.

2. FUEL AND/OR OXID ENGINE INLET PRESSURES GREATER THAN 120 PSIA (ULLAGE PRESSURES GREATER THAN 123 PSIA.) DURING A BURN WITH THROTTLE LESS THAN 65 PERCENT OR GREATER THAN 150 PSIA (ULLAGE PRESSURES GREATER THAN 160 PSIA.) WITH THROTTLE GREATER THAN 65 PERCENT.

3. TO INITIATE A BURN, THE OXIDIZER AND FUEL BULK TEMPERATURES MUST BE GREATER THAN 50 DEG F AND LESS THAN 90 DEG F.

4. DELTA TEMP BETWEEN FUEL AND OXID LESS THAN 25 DEG F FOR BURNS LESS THAN 400 SEC, AND LESS THAN 10 DEG F FOR BURNS GREATER THAN 400 SEC ONLY TO INITIATE A BURN.

5. (A) DELTA PRESSURE BETWEEN FUEL AND OXID ENGINE INLET PRESSURES LESS THAN 25 PSID PRIOR TO LOW GATE.

(B) DELTA PRESSURE (FUEL HIGH) LESS THAN 50 PSID AT START OF ANY BURN.

6. SUPERCRITICAL HELIUM ADEQUATE TO COMPLETE MISSION.

B. THE LOW THROTTLE POINT IS DEFINED AS THE MINIMUM POSITION THAT THE THROTTLE ACTUATOR WILL ASSUME WITH MINIMUM MANUAL THROTTLE COMMAND VOLTAGE.

C. DPS INSERTION CAPABILITY IS THE ABILITY TO OBTAIN A SAFE INSERTION WITH ONLY THE DPS.

RULES 25-3 THROUGH 25-10 ARE RESERVED.

R	ITEM	
	25-11	THE DPS ENGINE WILL NOT NORMALLY BE OPERATED FOR LESS THAN 3.5 SEC. A 2 SEC COAST BEFORE RESTART AT LTP AND A 30 MINUTE COAST BEFORE RESTARTS GREATER THAN LTP IS REQUIRED.
	25-12	RESERVED
	25-13	RESERVED
	25-14	FROM A SAFETY STANDPOINT SUPERCRITICAL HELIUM BURST DISC RUPTURE DURING MANNED OPERATION IS AN ALLOWABLE EVENT.
	25-15	PROPELLANT GAGING A. PRIME METHOD--- PQGS (TM, ONBOARD) (1.3 PERCENT) B. BACKUP METHOD--- GROUND MASS CALCULATION (3 PERCENT FOR GAGING)
	25-16	IF POWERED DESCENT IS ABORTED DURING DPS INSERTION CAPABILITY OR IF A DOCKED DPS CONTINGENCY IS REQUIRED, THE DES HE REG 1 AND REG 2 VALVES SHOULD BE CLOSED AT A PQGS READING OF 37 PERCENT TO INSURE A LOW ENOUGH TANK PRESSURE TO PREVENT A VIOLATION OF FRACTURE MECHANICS LIMITS FROM HEAT SOAK BACK.
		RULE NUMBERS 25-17 THROUGH 25-29 ARE RESERVED.

MISSION RULES

SECTION 25 - LM PROPULSION - DPS

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC MISSION RULES	
	25-30	LOSS OF OPERATIONAL DPS (PRIOR TO LOW GATE REF MR 25-2 FOR DEFINITION. AFTER LOW GATE ONLY LOW INLET PRESSURES LESS THAN 150 PSIA)	DOCKED/ UNDOCKED	A. INHIBIT DPS BURNS	REF MAL PROC DPS--- 1 DES REG 1A FUEL/OXID PRESS ABNORMAL 2 FUEL/OXID TEMP ABNORMAL 3 HE PRESS ABNORMAL
			PRE-PDI	B. RNDZ ASAP 1. INHIBIT PDI 2. RNDZ WITH APS	
			POWERED DESCENT	C. ABORT STAGE	
	25-31	START TANK LEAK PRIOR TO PRESSURIZATION			REF MAL PROC DPS--- 3 HE PRESS ABNORMAL
		A. FUEL AND/OR OXID ENGINE INLET P GREATER THAN 30 PSIA.	ALL	A. CONTINUE MISSION INHIBIT FIRING DPS START TANK SQUIB	
		B. FUEL AND/OR OXID ENGINE INLET P LESS THAN 30 PSIA.		B. CONTINUE MISSION 1. FIRE SQUIB TO START TANK	NOTE PRESSURIZATION SYSTEM MAY BE OPENED TO START TANK LEAK. CLOSE PRIMARY HE REG SOV AFTER EACH BURN AND REOPEN AT INITIATION OF EACH BURN.
	25-32	RESERVED			
	25-33	LOSS OF SUPERCRITICAL PRESSURE (DPS IN BLOWDOWN MODE)			REF MAL PROC DPS 3 HE PRESS ABNORMAL
		A. GREATER THAN 31 PERCENT PQGS	POWERED DESCENT	A. ABORT ABORT STAGE PRIOR TO INLET PRESSURES LESS THAN OR EQUAL TO 150 PSIA. (ULLAGE PRESSURE LESS THAN 160 PSIA.)	
		B. LESS THAN OR EQUAL TO 31 PERCENT PQGS		B. CONTINUE MISSION	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	25-34	LEAK BETWEEN SHE SQUIB AND QUAD CHECK VALVES	ALL	A. PRESSURIZE DPS WITH AMB TANK WHILE IN SITE COVERAGE 1. INHIBIT DPS BURNS FOR LEAK RATE GREATER THAN 20 PSI/SEC. 2. IF LEAK RATE LESS THAN 20 PSI/SEC (A) CLOSE HE REG 1 (B) OPEN DES HE REG 1 OR 2 IMMEDIATELY AFTER IGNITION.	REF MAL PROC DPS 1 DES REG 3 HE PRESS ABNORMAL NOTE--- MSFN WILL EVALUATE WHICH REG TO OPEN
		RULE NUMBER 25-35 RESERVED.			

MISSION RULES

SECTION 25 - LM PROPULSION - DPS

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	25-36	93 SEC AFTER LO LEVEL SENSE	POWERED DESCENT	CREW EVALUATION LAND OR ABORT	5 SEC CAPABILITY AT FTP 20 SEC CAPABILITY AT 25 PERCENT THROTTLE
	25-37	LOW LEVEL CONFIRMS INSUFFICIENT PROPELLANT TO LAND OR DELTA BETWEEN FUEL AND OXIDIZER PQGS READINGS GREATER THAN 13 PERCENT	POWERED DESCENT	A. ABORT B. ABORT STAGE AT DPS DEPLETION	REF MAL PROC DPS 6 DES QTY
	25-38	PQGS READING 2 PERCENT (EITHER FUEL OR OXID) AND NO VALID TIME ESTIMATE FROM LOW LEVEL	POWERED DESCENT	ABORT ABORT STAGE AT DPS DEPLETION	REF MAL PROC DPS 7 PQGS IND ABNORMAL NOTE--- THE GROUND CALC DPS QUANTITY WILL BE USED IF BOTH THE LOW LEVEL AND PQGS FAIL.
	25-39	EXCESSIVE PROPELLANT USAGE (PREDICTED MARGIN AT TOUCHDOWN LESS THAN -0.2 PERCENT).	POWERED DESCENT	A. PRIOR TO P64 - CONTINUE MISSION B. AFTER P64 BUT PRIOR TO LO GATE. 1. ABORT 2. ABORT STAGE AT DPS DEPLETION	NOTE---THROTTLEDOWN TIME, THRUST LEVEL, AND SYSTEM PRESSURES ARE SECONDARY CUES WHICH INDICATE OFF NOMINAL DPS PERFORMANCE.

MISSION RULES

SECTION 25 - LM PROPULSION - DPS

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	25-41	UNABLE TO VENT DPS AFTER LANDING.			
		A. UNABLE TO VENT DPS FUEL TANKS	LUNAR STAY	A. CONTINUE MISSION	
		B. UNABLE TO VENT OXIDIZER TANKS AND GREATER THAN 150 LBS OF OXIDIZER IN EACH OXIDIZER TANK		B. CONTINUE MISSION	
		C. UNABLE TO VENT OXIDIZER TANKS AND LESS THAN 150 LBS OF OXIDIZER IN EACH OXIDIZER TANK		C. STAY UNTIL AT LEAST T-3	NOTE--- STAY TIME DEPENDS UPON OXIDIZER REMAINING IN EACH TANK AND WILL BE DETERMINED REAL TIME.
	25-42	35 PERCENT THROAT AREA INCREASE EXCEEDED	ALL	ABORT STAGE	NOTE--- THROTTLE DOWN TIME, THRUST LEVEL, AND SYSTEM PRESSURES ARE SECONDARY CUES WHICH INDICATE OFF NOMINAL DPS PERFORMANCE
		RULES 25-42 THROUGH 25-49 ARE RESERVED.			

R | ITEM

DPS - PRELAUNCH INSTRUMENTATION

ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCER	CATEGORY		MISSION RULE REFERENCE
25-50	START TNK PRESS	GW3015P	HE MON	COMMON	HD		25-31,32,35
	HE REG PRESS	GW3018P	C&W	COMMON	HD	1 OF 2	25-34,30,35
	HE REG PRESS	GW3025P			HD	M-PCM	25-34,30,35
	HE PRESS	GW3435P			HD	1 OF 2	25-33,30,32
	HE PRESS	GW3436P	PRESS		HD	M	25-33,30,32
	FU TNK 1 QTY	GW3603Q	QTY	COMMON	HD	1 OF 2	25-37,38,39,45
	FU TNK 2 QTY	GW3604Q	QTY	COMMON	HD	M	25-37,38,39,40
	OX TNK 1 QTY	GW4103Q	QTY	COMMON	HD	1 OF 2	25-37,38,39,40
	OX TNK 2 QTY	GW4104Q	QTY	COMMON	HD	M	25-37,38,39,40
	FU 1 TEMP	GW3718T	TEMP MON	COMMON	HD	1 OF 2	25-30
	FU 2 TEMP	GW3719T	TEMP MON	COMMON	HD	M	25-30
	OX 1 TEMP	GW4218T	TEMP MON	COMMON	HD	1 OF 2	25-30
	OX 2 TEMP	GW4219T	TEMP MON	COMMON	HD	M	25-30
	FU PRESS	GW3611P			M		25-30,31,32,33,35
	OX PRESS	GW4111P			M		25-30,31,32,33,35
	TCP	GW6510P	THRUST	COMMON	M-PCM		25-30,41
	LOW LEVEL	GW4455X	DPS LOW	COMMON	M		25-36

R	ITEM	
		GENERAL
	26-1	RESERVED
	26-2	DEFINITIONS--- A. AN OPERATIONAL APS (PREPRESSURIZATION) IS DEFINED AS FOLLOWS--- 1. DELTA PRESS BETWEEN APS FUEL AND OXID ENGINE INLET PRESSURES LESS THAN 90 PSID. 2. DELTA TEMP BETWEEN APS FUEL AND OXID LESS THAN 10 DEG F. 3. APS FUEL AND/OR OXID TEMP GREATER THAN 50 DEG F AND LESS THAN 90 DEG F. 4. APS FUEL OR OXID INLET PRESSURE GREATER THAN 62 PSIA AND LESS THAN 220 PSIA. 5. REDUNDANT PRESSURIZATION PATHS AND NO HELIUM TANK OR HELIUM LINE LEAKS. B. AN OPERATIONAL APS (POST-PRESSURIZATION) IS DEFINED AS FOLLOWS--- 1. ADEQUATE SOURCE PRESSURE FOR DELTA V REQUIRED AND REDUNTANT PRESSURIZATION PATHS. 2. DELTA TEMP BETWEEN APS FUEL AND OXID LESS THAN 60 DEG F FOR BURNS LESS THAN 100 SECONDS AND 10 DEG F FOR BURNS GREATER THAN 100 SECONDS. 3. APS FUEL AND/OR OXID TEMP GREATER THAN 50 DEG F AND LESS THAN 120 DEG F FOR BURNS LESS THAN 100 SECONDS AND GREATER THAN 50 DEG F AND LESS THAN 90 DEG F FOR BURNS GREATER THAN 100 SECONDS. 4. APS FUEL AND/OR OXID INLET PRESSURES GREATER THAN 115 PSIA. (ULLAGE PRESSURE GREATER THAN 125 PSIA) 5. DELTA PRESSURE BETWEEN FUEL AND OXID INLET PRESSURES LESS THAN OR EQUAL TO 15 PSID.
		RULES 26-3 THROUGH 26-12 ARE RESERVED

R	ITEM	
		SYSTEMS MANAGEMENT
	26-13	THE MINIMUM IMPULSE OF THE APS ENGINE IS 1257 PLUS OR MINUS 104 LBS - SEC, WHICH CORRESPONDS TO AN ELECTRICAL ON/OFF TIME OF 0.5 SEC.
	26-14	ONLY PREMISSION APPROVED APS MULTIBURN PROFILES WILL BE EXECUTED, SINCE NO DATA EXISTS TO ALLOW REALTIME SUPPORT FOR EXAMINING APS FREEZING, CHARRING, BACKWALL TEMPERATURE CONSTRAINTS FOR MULTIBURN PROFILES.
	26-15	PROPELLANT GAGING (NO ONBOARD READOUT)--- A. PRIME METHOD--- APS QTY FROM LGC MASS CALCULATION (THREE PERCENT) B. BACKUP METHOD--- FLOW RATE X TIME (5 PERCENT)
		RULES 26-16 THROUGH 26-19 ARE RESERVED.

MISSION RULES

SECTION 26 - LM PROPULSION - APS

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC	
	26-20	LOSS OF AN OPERATIONAL APS	DOCKED/ UNDOCKED	A. RETURN TO CSM NO-GO FOR CIRC	REF MAL PROC APS 1 ASC PRESS
			PRE-PDI	B. RETURN TO CSM ASAP NO-GO FOR PDI	2 FUEL OR OXID TEMP ABNORMAL 2A FUEL OR OXID PRESS ABNORMAL
			POWERED DESCENT	C. ABORT USE DPS AS LONG AS POSSIBLE	3 HE PRESS ABNORMAL OR DECR.
			LUNAR STAY	D. ASCEND NEXT BEST OPPORTUNITY	
			RNDZ	E. USE RCS FOR TPI	
	26-21	APS HE SOURCE PRESSURE			REF MAL PROC APS 1 ASC PRESS
		A. LEAK PRIOR TO PRESSURIZATION	DOCKED/ UNDOCKED	A. 1. RETURN TO CSM NO-GO FOR CIRC	3 HE PRESS ABNORMAL OR DECR.
			PRE-PDI	2. RETURN TO CSM NO-GO FOR PDI	NOTE
			POWERED DESCENT	3. ABORT (A) USE DPS AS LONG AS POSSIBLE (B) OPTIMIZE APS HELIUM	ONE HELIUM BOTTLE CAN SUPPLY SUFFICIENT APS DELTA V CAPABILTY FOR NONLANDING ALTERNATE MISSIONS.
			LUNAR STAY	4. ASCEND NEXT BEST OPPORTUNITY (A) DO NOT ASC FEED (B) OPTIMIZE APS HELIUM	
		B. LEAK AFTER PRESSURIZATION	LUNAR STAY	B.1.(A) ASCEND IMMEDIATELY (B) DO NOT ASC FEED	
			RNDZ	2. CONTINUE MISSION	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	26-22	APS HE LEAK BETWEEN QUAD CHECK VALVES AND ASC HE REG 1 AND 2 SHUTOFF VALVES	DOCKED/ UNDOCKED	A. RETURN TO CSM NO-GO FOR CIRC	REF MAL PROC APS 3 HE PRESS ABNORMAL OR DECR.
			PRE-PDI	B. RETURN TO CSM NO-GO FOR PDI	
			POWERED DESCENT	C. ABORT (1) USE DPS AS LONG AS POSSIBLE (2) OPTIMIZE APS HELIUM	
			LUNAR STAY	D. ASCEND NEXT BEST OPPORTUNITY 1. DO NOT ASC FEED 2. OPTIMIZE APS HELIUM	
			RNDZ	E. CONTINUE MISSION CLOSE HE SOV'S	
	26-23	APS PROPELLANT/VAPOR LEAK DOWNSTREAM OF QUAD CHECK VALVES			REF MAL PROC APS 1. ASC PRESS
			UNDOCKED/ PRE-PDI	A. DOCK ASAP	2A FUEL OR OXID PRESS ABNORMAL 3. HE PRESS ABNORMAL OR DECR.
			POWERED DESCENT	B. ABORT 1. USE DPS AS LONG AS POSSIBLE	
			STAY	C. ASCEND IMMEDIATELY 1. DO NOT ASC FEED	
			RNDZ	D. USE RCS FOR TPI	

MISSION RULES

SECTION 26 - LM PROPULSION - APS

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	26-24	APS PROP VALVE MISMATCH (DELTA POS)	ALL	A. CONTINUE MISSION 1. IF BURNING OR HAVE HAD AT LEAST ONE APS, INHIBIT SUBSEQUENT APS BURNS	THIS INDICATION PRIOR TO FIRST APS ENGINE ON WILL BE CONSIDERED A TM FAILURE
	26-25	APS FU AND/OR OXID LOW LEVEL			APS MAL PROC APS 4 ASC QTY
		A. DURING ASCENT	ASCENT	A. CONTINUE MISSION 1. OPEN RCS MAINS 2. CLOSE ASC FEED	
		B. CONFIRMS INSUFFICIENT PROPELLANT FOR APS TPI	RNDZ	B. USE RCS FOR TPI	
		RULES 26-26 THROUGH 26-29 ARE RESERVED.			

R | ITEM

' APS - PRELAUNCH INSTRUMENTATION '

ITEM	MEAS DESCRIPTION	PCM	ONBOARD TRANSDUCER		CATEGORY	MISSION RULE REFERENCE
26-30	APS HE 1 PRESS	GP0001P	HEL MON C&W	COMMON	M - PCM	26-20,21,22
	APS HE 2 PRESS	GP0002P	HEL MON C&W	COMMON	M - PCM	26-20,21,22
	APS HE REG PRESS	GP0018P			HD 1 OF 2	26-20,22
	APS HE REG PRESS	GP0025P	C&W	COMMON	HD M - PCM	26-20,22
	APS HE 1 TEMP	GP0201T	HEL MON	COMMON	HD - PCM	26-21
	APS HE 2 TEMP	GP0202T	HEL MON	COMMON	HD - PCM	26-21
	APS FUEL TEMP	GP0718T	TEMP	COMMON	M - PCM	26-20
	APS FUEL LOW	GP0908X	C&W	COMMON	HD	26-25
	APS OXID TEMP	GP1218T	TEMP	COMMON	M - PCM	26-20
	APS OXID LOW	GP1408X	C&W	COMMON	HD	26-25
	APS FUEL PRESS	GP1501P	C&W	COMMON	M - PCM	26-20,21,22,23
	APS OXID PRESS	GP1503P	C&W	COMMON	M - PCM	26-20,21,22,23
	VLVS A DELTA POS	GP2997U			HD	26-24
	VLVS B DELTA POS	GP2998U			HD	26-25
	APS TCP	GP2010P			HD	

27 LM REACTION CONTROL SYSTEM

R	ITEM	
		' GENERAL '
	27-1	RESERVED
	27-2	DEFINITIONS

A. OPERATIONAL RCS SYSTEM

1. AN RCS SYSTEM CONTAINS EIGHT OPERATIONAL THRUSTERS SUPPLIED BY ITS OWN PRESSURIZATION AND PROPELLANT FEED SYSTEM INDEPENDENT OF ASCENT FEED AND CROSSFEED.*

2. FUEL AND/OR OXID MANIFOLD PRESSURES GREATER THAN OR EQUAL TO 100 PSI.

3. FUEL TEMP GREATER THAN OR EQUAL TO 40 DEG F AND LESS THAN OR EQUAL TO 100 DEG F.

4. QUAD TEMP GREATER THAN 119 DEG F.

*INDIVIDUAL THRUSTERS REQUIRED FOR DIFFERENT MISSION PHASES WILL BE COVERED SEPARATELY.

RULE NUMBERS 27-3 THROUGH 27-9 ARE RESERVED.

R	ITEM	
		SYSTEMS MANAGEMENT
	27-10	RESERVED
	27-11	USABLE RCS PROPELLANT IS 548.9 LBS OR 86.7 PERCENT OF TOTAL LOADED

TOTAL LOADED	633.0 LBS	100.0 PERCENT
TRAPPED AND LOADING ERROR	-46.2 LBS	- 7.3 PERCENT
TM ERROR*	-37.9 LBS	- 6.0 PERCENT
USABLE	548.9 LBS	86.7 PERCENT

*BASED ON A GROUND COMPUTATIONAL ACCURACY OF 6 PERCENT.

27-12 PROPELLANT GAGING

A. PRIME METHOD ---

GROUND RCS PROGRAM (6.0 PERCENT)

B. BACKUP METHOD---

PQMD (ONBOARD READOUT 13.0 PERCENT, GROUND READOUT 10.0 PERCENT)

RULE NUMBERS 27-13 THROUGH 27-19 ARE RESERVED.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC MISSION RULES	
	27-20	LOSS OF OPERATIONAL RCS SYSTEM A OR B	ALL	A. CLOSE MAINS OF AFFECTED SYSTEM IF LOSS OF SYSTEM RESULTED FROM ANYTHING OTHER THAN ISOLATION OF JETS	REF MAL PROC RCS 1 RCS 1A HE PRESS LOW OR DECR. 1B PQMD ABNORMAL 2 RCS PRESS OR TEMP ABNORMAL 3 RCS A(B) REG
				B. CROSSFEED FROM GOOD SYSTEM	
			DOCKED	DO NOT UNDOCK	
			UNDOCKED	DOCK ASAP	
				NO-GO FOR CIRC	
			PRE-PDI	RETURN TO CSM ASAP	
				NO-GO FOR PDI	
			POWERED DESCENT	ABORT ABORT STAGE	
			LUNAR STAY	ASCEND NEXT BEST OPPORTUNITY	
			RNDZ	CONTINUE MISSION	
	27-21	RCS THRUSTER PAIR			REF MAL PROC RCS
		A. ONE PAIR ISOLATED	DOCKED	A. 1. DO NOT UNDOCK	4 RCS TCA
			UNDOCKED	2. DOCK ASAP	A.1. WITH AN RCS PAIR ISOLATED SOME TRANSLATION CAPABILITY IS LOST DEPENDING ON THE RCS PAIR ISOLATED.
				NO-GO FOR CIRC	
			PRE-PDI	3. RETURN TO CSM ASAP	
				NO-GO FOR PDI	
			POWERED DESCENT/ LUNAR STAY/ RNDZ	4. CONTINUE MISSION	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	27-22	DECREASING OR LOSS OF RCS HE PRESSURE	ALL	A. 1. CONTINUE USING BOTH SYSTEMS UNTIL MFLD PRESS IN BAD SYSTEM IS LESS THAN 100 PSI, THEN CLOSE MAINS OF BAD SYSTEM	REF MAL PROC RCS 1 RCS 1A HE PRESS LOW OR DECR. 1B PQMD ABNORMAL
				2. CROSSFEED FROM GOOD SYSTEM	WHEN MFLD PRESS DROPS BELOW 100 PSI, THE SYSTEM IS CONSIDERED NON-OPERATIONAL REF RULE 27-2
			DOCKED/ UNDOCKED	B. RETURN TO CSM AND DOCK ASAP NO GO FOR CIRC	
			PRE-PDI	C. RETURN TO CSM AND DOCK ASAP NO-GO FOR PDI	
			POWERED DESCENT/ LUNAR STAY	D. 1. CONTINUE MISSION IF SUFFICIENT BLOWDOWN CAPABILITY EXISTS IN FAILED SYSTEM TO MEET THE RCS REDLINES DEFINED IN MR 3.97.	D. RCS TROUBLESHOOTING WILL NOT BE PERFORMED AFTER HI GATE
				2. IF THIS CAPABILITY DOES NOT EXIST--- A. PDI-ABORT B. LUNAR STAY-ASCEND NEXT BEST OPPORTUNITY	
			RNDZ	E. CONTINUE MISSION	
	27-23	RCS PROPELLANT LEAK BETWEEN MAINS AND ISOLATION VALVES	DOCKED UNDOCKED	A. 1. RETURN TO CSM ASAP 2. NO GO FOR CIRC	REF MAL PROC RCS 1 RCS
			PRE-PDI	B. RETURN TO CSM ASAP 1. NO-GO FOR PDI	1A HE PRESS LOW OR DECR. 1B PQMD ABNORMAL
			POWERED DESCENT	C. 1. PDI TO HIGH GATE A. ABORT 2. HIGH GATE TO TD A. CONTINUE MISSION	
			LUNAR STAY	D. ASCEND NEXT BEST OPPORTUNITY	
			RNDZ	E. CONTINUE MISSION	E. WITH AN RCS SYSTEM ISOLATED SOME TRANSLATION CAPABILITY IS LOST

MISSION RULES

SECTION 27 - LM REACTION CONTROL SYSTEM

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	27-24	RESERVED			
	27-25	IMPINGEMENT CONSTRAINTS VIOLATED	DOCKED/ UNDOCKED	A. DOCK ASAP NO GO FOR CIRC	REF MAL PROC RCS 1B PQMD ABNORMAL
			PRE-PDI	B. DOCK ASAP NO GO FOR PDI	
			POWERED DESCENT	C.1. ABORT 2. ABORT STAGE AS SOON AS POSSIBLE	
			LUNAR STAY	D. CONTINUE MISSION	
			RNDZ	E. USE RCS + Z FOR TPI	
		RULES 27-26 THROUGH 27-29 ARE RESERVED.			

R | ITEM

' PRELAUNCH INSTRUMENTATION '

ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCER	CATEGORY	MISSION RULE REFERENCE
27-30	RCS ''A'' PROP QTY	GR1085Q	QUANTITY	COMMON	HD 1OF2	27-23,22,20
	RCS ''A'' HE PRESS	GR1101P	PRESS MON C&W	COMMON	HD M	27-23,20
	RCS ''A'' REG PRESS	GR1201P	PRESS MON C&W	COMMON	HD-PCM	27-20,22,23
	RCS ''B'' REG PRESS	GR1202P	PRESS MON C&W	COMMON	HD-PCM	27-20,22,23
	RCS ''B'' PROP QTY	GR1095Q	QUANTITY	COMMON	HD 1OF2	27-23,20,22
	RCS ''B'' HE PRESS	GR1102P	PRESS MON C&W	COMMON	HD M	27-23,20
	RCS ''A'' FUEL TEMP	GR2121T	TEMP MON	COMMON	M-PCM	27-20
	RCS ''B'' FUEL TEMP	GR2122T	TEMP MON	COMMON	M-PCM	27-20
	RCS MAIN ''A'' CLSD	GR9609U	MAIN SOV	COMMON	HD	
	RCS MAIN ''B'' CLSD	GR9610U	MAIN SOV	COMMON	HD	
	RCS ''A'' FUEL MFLD PRESS	GR2201P	PRESS MON	COMMON	M	27-20,23
	RCS ''B'' FUEL MFLD PRESS	GR2202P	PRESS MON	COMMON	M	27-20,23
	RCS ''A'' OX MFLD PRESS	GR3201P	PRESS MON	COMMON	M	27-20,23
	RCS ''B'' OX MFLD PRESS	GR3202P	PRESS MON	COMMON	M	27-20,23
	A/B XFEED OPEN	GR9613U	CRSFD	COMMON	HD	
	QUAD 1 ''A'' TCA ISOL VLV	GR9667U	SYS A QUAD 1	COMMON	HD	27-21
	QUAD 2 ''A'' TCA ISOL VLV	GR9665U	SYS A QUAD 2	COMMON	HD	27-21
	QUAD 3 ''A'' TCA ISOL VLV	GR9663U	SYS A QUAD 3	COMMON	HD	27-21
	QUAD 4 ''A'' TCA ISOL VLV	GR9661U	SYS A QUAD 4	COMMON	HD	27-21
	QUAD 1 ''B'' TCA ISOL VLV	GR9668U	SYS B QUAD 1	COMMON	HD	27-21
	QUAD 2 ''B'' TCA ISOL VLV	GR9666U	SYS B QUAD 2	COMMON	HD	27-21
	QUAD 3 ''B'' TCA ISOL VLV	GR9664U	SYS B QUAD 3	COMMON	HD	27-21
	QUAD 4 ''B'' TCA ISOL VLV	GR9662U	SYS B QUAD 4	COMMON	HD	27-21
	QUAD 1 TEMP	GR6004T	TEMP MON	COMMON	HD	27-24
	QUAD 2 TEMP	GR6003T	TEMP MON	COMMON	HD	27-24
	QUAD 3 TEMP	GR6002T	TEMP MON	COMMON	HD	27-24
	QUAD 4 TEMP	GR6001T	TEMP MON	COMMON	HD	27-24
	ASC FEED OXID ''A'' OPEN	GR9641U	SYS A ASC OXID ASC FUEL	COMMON	HD	
	ASC FEED FUEL ''A'' OPEN	GR9631U	SYS A ASC OXID ASC FUEL	COMMON	HD	
	ASC FEED FUEL ''B'' OPEN	GR9632U	SYS B ASC OXID ASC FUEL	COMMON	HD	
	ASC FEED OXID ''B'' OPEN	GR9642U	SYS B ASC OXID ASC FUEL	COMMON	HD	

R	ITEM	
		' GENERAL '
	28-1	ALL DECISIONS WILL BE BASED ON CONFIRMED MEASUREMENTS AND/OR EVENTS AND PROJECTIONS BASED ON CONFIRMED EVENTS.
	28-2	DEFINITIONS---
		A. THE MAXIMUM OPERATIONAL DOSE (MOD) IS THE MAXIMUM RADIATION DOSE TO WHICH THE CREW WOULD BE SUBJECTED BASED ON A SKIN DOSE OF 400 RAD AND/OR A DEPTH (GASTROINTESTINAL) DOSE OF 50 RAD.
		B. THE PLANNING OPERATIONAL DOSE (POD) IS THE MAXIMUM RADIATION DOSE TO THE CREW WHICH ANY MISSION WOULD BE DESIGNED DURING THE PLANNING PERIOD BASED ON A SKIN DOSE OF 250 RAD AND/OR A DEPTH DOSE OF 25 RADS.
		C. THESE DOSES REPRESENT THE CUTOFF POINT WHERE A DECISION MUST BE MADE WHETHER TO CONTINUE OR TERMINATE THE MISSION.
		D. THE RADIATION ABSORBED DOSE (RAD) IS A UNIT OF ABSORBED DOSE WHICH IS EQUAL TO AN ENERGY DEPOSITION OF 100 ERGS/GRAM.
		E. THE RELATIVE BIOLOGICAL EFFECTIVENESS (RBE) EXPRESSES THE EFFECTIVENESS OF PARTICULAR TYPES OF RADIATION IN PRODUCING THE SAME BIOLOGICAL RESPONSE. THE AVERAGE RBE THAT WILL BE USED FOR SOLAR PARTICLE EVENT RADIATION FROM PROTONS IS 1.2.
		F. THE ROENTGEN EQUIVALENT MAN (REM) IS THE PRODUCT OF THE RAD AND THE RBE (REM = RAD X RBE).
		G. A CONFIRMED EVENT IS DEFINED AS AN EVENT THAT HAS BEEN MEASURED BY TWO OR MORE INDEPENDENT SOURCES.
		H. A SIGNIFICANT INCREASE OF THE MOD WILL BE DEFINED BY THE FLIGHT SURGEON IN REAL TIME BASED ON THE CHARACTER AND ACCURACY OF THE DATA AT THE TIME.

R	ITEM	
		' MANAGEMENT '
	28-3	THE EXISTING AND PROJECTED RADIATION ENVIRONMENT WILL BE A PART OF THE GO/NO-GO DECISION PROCESS.
	28-4	PRIORITY OF DATA---
		A. NATURAL (SOLAR PARTICLE EVENT)
		1. PRELAUNCH AND EPO
		(A) SOLAR PARTICLE ALERT NETWORK (SPAN)
		(B) VELA NATURAL RADIATION SATELLITE
		(C) PIONEER RADIATION SATELLITE
		(D) EXPLORER RADIATION SATELLITE
		(E) SOLAR PARTICLE MONITORING SYSTEM (SPMS)
		2. ALL OTHER PHASES
		(A) S/C INSTRUMENTATION
		(1) VAN ALLEN BELT DOSIMETER (VABD)
		(2) PERSONAL RADIATION DOSIMETER (PRD)
		(3) NUCLEAR PARTICLE DETECTION SYSTEM (NPDS)
		(B) SOLAR PARTICLE ALERT NETWORK (SPAN)
		(C) VELA NATURAL RADIATION SATELLITE
		(D) PIONEER RADIATION SATELLITE
		(E) EXPLORER RADIATION SATELLITE
		(F) SOLAR PARTICLE MONITORING SYSTEM (SPMS)
		B. ARTIFICIAL
		1. ALL PHASES EXCEPT EPO
		(A) JAEIC
		(B) RIOMETER
		2. EPO
		(A) JAEIC
		(B) RIOMETER
		(C) PRD
		3. EARTH ORBITAL MISSION
		(A) PRD
		(B) JAEIC
		(C) RIOMETER
		RULE NUMBERS 28-5 THROUGH 28-9 ARE RESERVED.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC MISSION RULES	
	28-10	ANY SOURCE REPORTS A POSSIBLE ARTIFICIAL EVENT	ALL	PROCEED UNTIL VERIFICATION FROM ALL OTHER SOURCES.	
	28-11	DEFINITE ARTIFICIAL EVENT CONFIRMED BY REPORTING SOURCES	PRE-LAUNCH	A. HOLD UNTIL INFORMATION FROM REPORTING SOURCES INDICATES THE MOD WILL NOT BE EXCEEDED.	
			EPO	B.1. CONTINUE MISSION. UNLESS DATA ANALYSIS INDICATES THAT THE DOSE PROJECTED THROUGH TLI WILL EXCEED THE MOD BY A SIGNIFICANT AMOUNT. IF THE MOD WILL BE EXCEEDED BY A SIGNIFICANT AMOUNT, PERFORM A LOW EARTH ORBIT ALTERNATE MISSION. 2. FOR DOSES APPROACHING THE MOD CONTINUE MISSION WITH CONTINUOUS PRD MONITORING AND CREW ASSESSMENT. CONSIDERATIONS WILL BE GIVEN TO CHANGING THE TRAJECTORY TO A LOW EARTH ORBIT OR REENTERING ASAP BASED ON ACTUAL CONDITIONS.	B.1. CREW SHOULD BEGIN PERSONAL DOSIMETER READOUTS PER SOP 2-8
			ALL OTHER	C. CONTINUE MISSION.	
	28-12	RADIATION CONFIRMED BY PRD READOUTS OR ONBOARD TM AND PROJECTED TO EXCEED THE MOD	ALL	REENTER NEXT BEST PTP	ALSO APPLIES TO ALTERNATE EARTH ORBIT MISSION.
	28-13	MAJOR SOLAR FLARE PREDICTED	ALL	CONTINUE MISSION.	

MISSION RULES

SECTION 28 - SPACE ENVIRONMENT

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	28-14	MAJOR SOLAR FLARE HAS OCCURRED			
		A. UNCONFIRMED PARTICLE EVENT	ALL	A. CONTINUE MISSION.	
		B. CONFIRMED PARTICLE EVENT AND SOLAR PARTICLE ALERT NETWORK/RTACF ANALYSIS INDICATES THE MOD WILL BE EXCEEDED DURING THE MISSION	PRE-LAUNCH	B.1. HOLD UNTIL DATA ANALYSIS INDICATES THAT THE MOD WILL NOT BE EXCEEDED.	
			EPO	B.2. CONTINUE MISSION. IF DATA ANALYSIS INDICATES THAT THE MOD WILL BE EXCEEDED BY A SIGNIFICANT AMOUNT PRIOR TO MISSION COMPLETION, TLI IS NO-GO.	
			ALL OTHERS	3. CONTINUE MISSION. CONSIDERATION WILL BE GIVEN TO EARLY (OR EXTENDED) TEI AND INHIBITING CREW TRANSFER TO LM.	
		C. CONFIRMED PARTICLE EVENT AND S/C TLM OR PRD READOUT PROJECTIONS INDICATE THE MOD WILL BE EXCEEDED DURING THE MISSION	TLC	C.1. CONTINUE MISSION. CONSIDERATION SHOULD BE GIVEN TO ENTER IN NEXT BEST PTP IF THE TOTAL DOSE CAN BE REDUCED SIGNIFICANTLY WITHOUT INCREASING THE TOTAL RISK TO THE CREW.	C.1. CREW SHOULD BEGIN PERSONAL DOSIMETER AND RADIATION SURVEY METER READOUTS PER SOP 2-8
			LO	2. CONTINUE MISSION. CONSIDER EXTENDING LUNAR ORBIT STAY TIME IF THE TOTAL DOSE TO THE CREW WOULD BE REDUCED SIGNIFICANTLY BY LUNAR SHIELDING.	2.(A) HATCH-DOWN ATTITUDE MAY BE USED TO REDUCE THE TOTAL DOSE. (B) IF A PARTICLE EVENT IS CONFIRMED THE CREW WILL TRANSFER FROM THE LM TO THE CSM ASAP.
			LUNAR STAY	3. CONSIDER REDUCING THE LUNAR STAY TIME AND/OR EVA IF THE TOTAL DOSE TO THE CREW CAN BE REDUCED SIGNIFICANTLY WITHOUT INCREASING THE TOTAL RISK TO THE CREW.	
			ALL OTHER PHASES	4. CONTINUE MISSION	

R	ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REF
		' INSTRUMENTATION REQUIREMENTS '					
	28-15	RADIATION DOSIMETER 1 (CM DEPTH DOSE RATE)	CK1051K	-	-	HD	28-12
		VABD					
		RADIATION DOSIMETER 2 (CM SKIN DOSE RATE)	CK1052K	-	-	HD	28-12
		DOSIMETER RATE CHANGE	CK1053R	-	-	HD	28-12
		NPDS					
		PROTON COUNT RATE CHAN 1	ST0820K	-	-	HD	28-14
		PROTON COUNT RATE CHAN 2	ST0821K	-	-	HD	28-14
		PROTON COUNT RATE CHAN 3	ST0822K	-	-	HD	28-14
		PROTON COUNT RATE CHAN 4	ST0823K	-	-	HD	28-14
		ALPHA COUNT RATE CHAN 1	ST0830K	-	-	HD	28-14
		ALPHA COUNT RATE CHAN 2	ST0831K	-	-	HD	28-14
		ALPHA COUNT RATE CHAN 3	ST0832K	-	-	HD	28-14
		PROTON INTEGER COUNT RATE	ST0838K	-	-	HD	28-14
		TEMP NUCLEAR PART. DET	ST0840T	-	-	HD	28-14
		TEMP NUCLEAR PART. ANAL	ST0841T	-	-	HD	28-14
		PERSONAL RADIATION DOSIMETER (PRD)	-	3 - ONBOARD	-	MANDATORY TO BE ONBOARD	28-14
		RATE SURVEY METER (RSM)	-	1 - ONBOARD	-	MANDATORY TO BE ONBOARD	28-14

29 RECOVERY

MISSION RULES

SECTION 29 - RECOVERY

SPECIFIC

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	29-1	ACCEPTABLE WEATHER CONDITIONS AND RECOVERY CAPABILITY* IN THE LAUNCH SITE AREA.	PRELAUNCH	MANDATORY	
	29-2	ACCEPTABLE WEATHER CONDITIONS AND RECOVERY CAPABILITY* IN THE LAUNCH ABORT AREA TO 1000 NM DOWNRANGE AND IN THE MIDPACIFIC RECOVERY ZONE	PRELAUNCH	HIGHLY DESIRABLE	
	29-3	MINIMUM OF 71 AMP HOURS OF CM POSTLANDING POWER AVAILABLE AT LANDING.		HIGHLY DESIRABLE	TO PROVIDE 40 HOURS OF CM POSTLANDING POWER PLUS ONE UPRIGHTING.
	29-4	MINIMUM OF 35 AMP HOURS OF CM POSTLANDING POWER AVAILABLE AT LANDING.		MANDATORY	TO PROVIDE 18 HOURS OF CM POSTLANDING POWER PLUS ONE UPRIGHTING.
	29-5	UNTIL ENTRY - 24 HOURS, RETAIN DELTA V CAPABILITY TO MOVE ENTRY POINT +/-500 NM		HIGHLY DESIRABLE	TO PROVIDE WEATHER AVOIDANCE CAPABILITY.

*RECOVERY CAPABILITY WILL BE BASED PRIMARILY UPON THE LOCAL RECOVERY UNIT COMMANDER'S EVALUATION OF HIS CAPABILITY TO PERFORM THE RECOVERY OPERATION. WEATHER CONDITIONS AT THE TIME OF CM LANDING AFFECT BOTH RECOVERY CAPABILITY AND STRUCTURAL INTEGRITY OF THE CM. THE FOLLOWING GUIDELINES ARE USED TO INDICATE WHEN IT MAY BE NECESSARY TO RE-EVALUATE---

	WORLD WIDE	LAUNCH SITE
SURFACE WINDS	25 KNOTS	25 KNOTS
CEILING	1500 FT	500 FT.
VISIBILITY	3 NM	1/2 NM
WAVE HEIGHT	8 FT	8 FT

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	29-6	AN ELLIPSE 163 NM UPRANGE, 152 NM DOWNRANGE AND 50 NM TO EITHER SIDE OF 55 DEG/55DEG TARGET POINT-- AND AN ELLIPSE 105 NM UPRANGE AND DOWNRANGE AND 40 NM TO EITHER SIDE OF THE ROLL RIGHT 90 DEG (DELAYED) TARGET POINT WILL BE CLEAR OF ALL LAND.	EARTH ORBITAL	MANDATORY	
	29-7	REMAINDER OF MANEUVER FOOTPRINT AND AN ELLIPSE 109 NM UPRANGE AND DOWNRANGE AND 40 NM TO EITHER SIDE OF 90 DEG/90DEG TARGET POINT-- AND ELIPSE 105 NM UPRANGE AND DOWNRANGE AND 40 NM TO EITHER SIDE OF ROLL RIGHT 90 DEG TARGET POINT WILL BE CLEAR OF LARGE LAND MASSES.	EARTH ORBITAL	HIGHLY DESIRABLE	
	29-8	A 5 NM RADIUS CIRCLE CENTERED ON THE GNCS TARGET POINT AND AN ELLIPSE 26 NM UPRANGE, 26 NM DOWNRANGE AND 52 NM EITHER SIDE OF THE EMS TARGET POINT WILL BE CLEAR OF ALL LAND.	POST-TLI	MANDATORY	
	29-9	REMAINDER OF OPERATIONAL FOOTPRINT (SEE RULE 1-40) WILL BE CLEAR OF LARGE LAND MASSES	POST-TLI	HIGHLY DESIRABLE	

R	ITEM	
		GENERAL
	30-1	PRELAUNCH PRIOR TO COMMITING TO LAUNCH, THE FOLLOWING CONDITIONS MUST BE MET--- A. SATISFACTORY FLIGHT CREW PHYSIOLOGICAL STATUS. B. THE MINIMUM CABIN OXYGEN CONCENTRATION FOR LAUNCH IS 60 PERCENT. C. THE MINIMUM SUIT OXYGEN CONCENTRATION FOR LAUNCH IS 95 PERCENT.
	30-2	THE SUIT CIRCUIT MUST BE MAINTAINED AT LEAST 2 IN. WATER PRESSURE ABOVE THE CABIN PRESSURE. SUIT LOOP PURGE IS REQUIRED IF THE SUIT-TO-CABIN DELTA PRESSURE REMAINS AT ZERO FOR A PERIOD OF 5 MINUTES.
	30-3	THE POTABLE WATER PH MUST BE WITHIN 6.0 TO 8.0 AT SERVICING AND FINAL SAMPLING.
	30-4	THE MAXIMUM ALLOWABLE CONCENTRATION OF PCO2 IS 5MM OF HG.
	30-5	LAUNCH THERE ARE NO MEDICAL REASONS FOR ABORTING DURING THE LAUNCH PHASE OTHER THAN THOSE CONDITIONS INTOLERABLE TO THE CREW.
	30-6	EARTH ORBIT AND DEEP SPACE OPERATIONS. EARLY MISSION TERMINATION FOR MEDICAL FALL INTO TWO CATEGORIES--- A. ONSET OF CONDITIONS WHICH ADVERSELY AFFECT CREW SAFETY HEALTH, OR FUNCTION AND PERFORMANCE. B. FAILURE OF SPACECRAFT SYSTEMS TO MAINTAIN A PHYSIOLOGICALLY SATISFACTORY ENVIRONMENT.
	30-7	WATER PALATABILITY CREW EVALUATION OF THE DRINKING WATER TASTE WILL BE THE BASIS FOR DETERMINING WATER PALATABILITY, EVEN FOR KOH CONTAMINATION.
		RULE NUMBERS 30-8 THROUGH 30-14 ARE RESERVED

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
				SPECIFIC MISSION RULES	
	30-15	LOSS OR UNREADABLE EKG	ALL PHASES	A. CONTINUE MISSION	A. ARTIFACTS ANTICIPATED DURING LAUNCH. MCC SURGEON WILL EVALUATE THE PROBLEM AND MAY RECOMMEND EARLY MISSION TERMINATION IF CORRECTIVE ACTION IS NOT EFFECTIVE.
			EVA	B. CONTINUE MISSION	B. MCC SURGEON WILL EVALUATE PROBLEM AND RECOMMEND CORRECTIVE ACTION. IF NOT EFFECTIVE, CEVA MAY BE RECOMMENDED.
	30-16	ABNORMAL HEART RATE, RHYTHM OR EKG	LAUNCH	A. CONTINUE MISSION	MCC SURGEON WILL EVALUATE THE PROBLEM AND MAY RECOMMEND EARLY MISSION TERMINATION IF CORRECTIVE ACTION IS NOT EFFECTIVE.
			EPO	B. NO-GO FOR TLI	
			TLC	C. NO-GO FOR LOI	
			LO	D. ENTER NEXT BEST PTP	
			EVA	E. TERMINATE EVA	
			TEC	F. ENTER NEXT BEST PTP	
	30-17	ABNORMAL RESPIRATORY RATE	LAUNCH	A. CONTINUE MISSION	THE ABNORMAL RATES WILL BE EVALUATED BY THE MCC SURGEON AND EARLY MISSION TERMINATION MAY BE RECOMMENDED IF CORRECTIVE ACTION IS NOT EFFECTIVE.
			EPO	B. NO-GO FOR TLI	
			TLC	C. NO-GO FOR LOI	
			LO	D. ENTER NEXT BEST PTP	
			TEC	E. ENTER NEXT BEST PTP	
	30-18	ONSET OF SERIOUS MEDICAL PROBLEM	LAUNCH	A. CONTINUE MISSION CREW MAY ELECT TO ABORT IF INTOLERABLE	MCC SURGEON WILL EVALUATE AND MAY RECOMMEND EARLY MISSION TERMINATION IF CORRECTIVE ACTION IS NOT EFFECTIVE.
			EPO	B. ENTER NEXT BEST PTP	
			TLC	C. ENTER NEXT BEST PTP	
			LO	D. ENTER NEXT BEST PTP	
			EVA	E. TERMINATE EVA	
			TEC	F. ENTER NEXT BEST PTP	

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	30-19	DYSBARISM IN ANY CREWMAN	LAUNCH	A. CONTINUE MISSION CREW MAY ELECT TO ABORT IF CONDITION IS INTOLERABLE	A.1. CHECK SUIT INTEGRITY. 2. IF CONDITIONS PERMIT CREW MAY ELECT TO OVER- PRESSURIZE. (A) ALL THREE SUITS CONNECTED TO SUIT CIRCUIT. (B) SUIT DEMAND REG TO PRESS POSITION (C) MONITOR SUIT PRESS (SHOULD REACH 4 PSID IN 75 SEC). (D) SELECT SUIT DEMAND REG INLET SEL VALVE TO OFF WHEN SUIT PRESS REACHES 4.0 PSID. (E) MAINTAIN SUIT OVERPRESSURE BY OPENING INLET SELECTOR VALVE AS NECESSARY. NOTE--- RELIEF FUNCTION OF DEMAND REGULATOR IS ISOLATED WHEN USING THIS PROCEDURE.
			ALL	B. TERMINATE PHASE ENTER NEXT BEST PTP	B. MCC SURGEON WILL EVALUATE AND MAY RECOMMEND EARLY MISSION TERMINATION IF CORRECTIVE ACTION IS NOT EFFECTIVE.
	30-20	ORAL TEMP EXCEEDS 101 DEG F. DESPITE CORRECTIVE ACTION.			MCC SURGEON MAY RECOMMEND EARLY MISSION TERMINATION IF TREATMENT IS UNSUCCESSFUL.
		A. IF DUE TO ILLNESS	LAUNCH	A.1. NOT APPLICABLE	
			ALL	2. TERMINATE PHASE ENTER NEXT BEST PTP	
		B. IF RESULTANT FROM THERMAL OVERLOAD	LAUNCH	B.1. NOT APPLICABLE	
			ALL	2. TERMINATE PHASE ENTER NEXT BEST PTP	
	30-21	PLSS METABOLIC OVERLOAD.	EVA	A. IF AMBER LINE IS EXCEEDED--- DECREASE ACTIVITY.	A. AMBER LINE LIMIT IS WORK SUSTAINED AT A RATE GREATER THAN 2500 BTU/HR FOR A PERIOD LONGER THAN 5 MINUTES. AS DETERMINED BY PREFLIGHT ERGOMETRY CALIBRATIONS. THE MCC SURGEON WILL EVALUATE AND MAY RECOMMEND DECREASED CREW ACTIVITY.
				B. IF RED LINE IS EXCEEDED--- STOP ACTIVITY AND REST.	B. RED LINE LIMIT IS WORK SUSTAINED AT A RATE GREATER THAN 3000 BTU/HR FOR A PERIOD LONGER THAN 2 MINUTES. AS DETERMINED BY PREFLIGHT ERGOMETRY CALIBRATIONS. MCC SURGEON WILL EVALUATE AND MAY RECOMMEND THAT THE CREW STOP ACTIVITY AND REST.
		RULE NUMBERS 30-22 THROUGH 30-24 ARE RESERVED.			

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	30-25	INCREASE IN PCO2			
		A. IS GREATER THAN OR EQUAL TO 7.6 MM HG	LAUNCH	A.1. CONTINUE MISSION	A. PCO2 SHOULD DECREASE BELOW 2 MM HG WITHIN 30 MINUTES.
			ALL	2. CONTINUE MISSION CHANGE LIOH CANISTER	
		B. GREATER THAN OR EQUAL TO 7.6 MM HG AND UNABLE TO DECREASE	LAUNCH	B.1. CONTINUE MISSION	
			ALL	2. CONTINUE MISSION (A) OPEN SUITS AND BREATHE FROM CABIN (B) CHANGE SECOND LIOH CANISTER (C) TEST PCO2 SENSOR	B.2. LIOH CANISTERS WILL NOT BE CHANGED IN AN UNPRESSURIZED CABIN. B.2.(C) PCO2 SENSOR TEST--- • ISOLATE SUIT CIRCUIT BY DISCONNECTING SUIT HOSES FROM THE SPACECRAFT • SUIT CIR RET AIR VALVE CLOSED • CRACK O2 METERING VALVE TO OPEN • PURGE FOR 30 SECONDS • CLOSED O2 METERING VALVE • IF ABOVE PROCEDURE RESULTS IN A PCO READING NEAR ZERO, THE PCO2 SENSOR IS OPERATING PROPERLY
		C. GREATER THAN OR EQUAL TO 10 MMHG	LAUNCH ALL	C.1. CONTINUE MISSION 2. TERMINATE PHASE ENTER NEXT BEST PTP	
	30-26	PCO2 INSTRUMENTATION FAILURE	ALL	CONTINUE MISSION USE ONBOARD CO2 TAPES	
		RULE NUMBER 30-27 THROUGH 30-34 ARE RESERVED.			

R | ITEM

INSTRUMENTATION REQUIREMENTS

CSM

ITEM	MEAS DESCRIPTION	PCM	ONBOARD	TRANSDUCERS	CATEGORY	MISSION RULE REFERENCE
30-35	ELECTROCARDIOGRAM	CJ0060J	NOT DISPLAYED		M*	30-15/16
	ELECTROCARDIOGRAM	CJ0061J	NOT DISPLAYED		M*	30-15/16
	ELECTROCARDIOGRAM	CJ0062J	NOT DISPLAYED		M*	30-15/16
	CO2 PARTIAL PRESSURE	CF0005P	METER	COMMON	HD	30-2/27/28
	SUIT CABIN DELTA PRESS	CF0003P	NOT DISPLAYED		HD	30-3/19
	ORAL TEMPERATURE		CLINICAL THERMOMETER		M*	30-20
	PNEUMOGRAM	CJ0200R	NOT DISPLAYED		HD	30-17
	PNEUMOGRAM	CJ0201R	NOT DISPLAYED		HD	30-17
	PNEUMOGRAM	CJ0202R	NOT DISPLAYED		HD	30-17

LM

	CO2 PARTIAL PRESSURE	GF1521P	METER		HD	
	ELECTROCARDIOGRAM	GT9999	NOT DISPLAYED		M*	30-15/16
	PNEUMOGRAM		NOT DISPLAYED		HD	30-17

PLSS

	PLSS ELECTROCARDIOGRAM	GT8124J			M*	30-15/16

*MANDATORY TO CABIN CLOSEOUT

R	ITEM	
		' GENERAL '
	31-1	FOR ANY MALFUNCTION ON A SCIENTIFIC TASK, A MAXIMUM OF 10 MINUTES WILL BE SPENT ON THE CONTINGENCY PROCEDURE BEFORE THE TASK IS ABANDONED WITH THE FOLLOWING EXCEPTIONS--- A. RTG FUELING-- UP TO 20 MINUTES WILL BE ALLOWED IN EXERCISING RTG FUELING CONTINGENCY PROCEDURES. B. ALSEP PACKAGE 1 TO PACKAGE 2 CABLE CONNECTION-- UP TO 20 MINUTES WILL BE ALLOWED FOR MAKING THE CABLE CONNECTION. C. ALSEP ANTENNA-- UP TO 30 MINUTES WILL BE ALLOWED FOR ANTENNA ERECTION AND ALIGNMENT.
	31-2	RESERVED
	31-3	RESERVED

R	ITEM	
	31-4	RESERVED
	31-5	CAMERA FRAME COUNTS WILL BE OBTAINED AT A SUFFICIENT FREQUENCY (APPROXIMATELY 30-MINUTE INTERVALS) TO ENABLE ACCURATE CORRELATION OF SAMPLES AND PHOTOS FOR SAMPLE ORIENTATION.
	31-6	IN ESTABLISHING THE OPERATIONAL EVA PLAN, THE TRAVERSE PLANS PREPARED BEFORE LAUNCH WILL BE USED AS BASELINES AND MODIFIED AS NECESSARY TO ACCOMMODATE THE ACTUAL LANDING POINT, RADIUS OF OPERATIONS AND TIMELINE CONSTRAINTS, AND SPECIFICALLY INTERESTING FEATURES VISIBLE TO THE CREW.
	31-7	THE OPERATIONAL EVA PLAN WILL BE TIME CONSTRAINED TO A MAXIMUM DURATION OF 4.25 HOURS. THE RADIUS DISTANCE CONSTRAINT, FROM THE LM, IS 3 KM WHEN THE BSLSS IS CARRIED AND 1 KM WHEN THE BSLSS IS NOT CARRIED. EXTENSIONS, DETERMINED DURING THE EVA BASED ON CONSUMABLES USAGE RATES AND CREW COMFORT TO A MAXIMUM OF 5 HOURS, MAY BE IMPLEMENTED. PROABLE EXTENSION POINTS WILL BE AFTER ALSEP DEPLOYMENT (FOR EVA 1) AND AT TRAVERSE SITES FARTHEST FROM THE LM (FOR EVA 2)
	31-8	THE CREW WILL HAVE PRIME RESPONSIBILITY FOR--- A. SELECTION OF SAMPLES TO BE COLLECTED. B. DECISIONS TO DEPART FROM THE OPERATIONAL EVA. C. ON THE SPOT DETERMINATION OF BEST TRAVERSE PATH TO PROVIDE MOBILITY EASE. D. ON THE SPOT DETERMINATION OF ACCESSIBILITY OF FEATURES OF INTEREST. E. SELECTION OF A SUITABLE LOCATION FOR PERFORMING EVA COMMUNICATIONS TEST. F. SELECTION OF APPROPRIATE PLACES FOR MET/SOIL INTERACTION EVALUATION. G. SELECTION OF APPROPRIATE PLACES FOR LUNAR SURFACE CLOSE-UP CAMERA PHOTOGRAPHY.

R	ITEM	
	31-9	GROUND INITIATED CHANGES TO THE OPERATIONAL EVA PLAN WILL BE LIMITED. THE FOLLOWING CONDITIONS WILL BE DEEMED REASONABLE CAUSES FOR GROUND INITIATED CHANGES. A. UNEXPECTED FEATURES OF SIGNIGICANT SCIENTIFIC INTEREST REPORTED BY THE CREW. B. CONSUMABLES CONSUMPTION RATES OR OTHER CONDITIONS NECESSITATE CURTAILMENT OR TERMINATION OF EVA. C. CONSUMABLES CONSUMPTION RATES PERMIT EXTENSION OF EVA. D. ENCOUNTERED OR PROJECTED INABILITY TO ACCOMPLISH SPECIFIC TASKS IN THE OPERATIONAL EVA PLAN.
	31-10	ONE-MAN EVA'S WILL BE ALLOWED FOR COMPLETION OF THE FOLLOWING ACTIVITIES WITHIN TIME CONTRAINTS, IN PRIORITY ORDER--- A. ABORTED EVA TERMINATION TASKS. B. CONTINGENCY SAMPLE COLLECTION. C. ALSEP DEPLOYMENT. D. COLLECTING SELECTED SAMPLES. E. LRRR DEPLOYMENT. F. COMPREHENSIVE SAMPLE COLLECTION. G. OTHER TASKS WITHIN THE CAPABILITY OF A SINGLE CREWMAN.
	31-11	FOR ONE-MAN EVA'S THE RADIUS OF OPERATIONS WILL BE LIMITED TO 300 METERS FROM LM.
	31-12	FOR SITUATIONS REQUIRING DELETIONS OF TASKS TO MAKEUP TIMELINE LAGS, THE FOLLOWING TASKS IN THE LISTED ORDER WILL BE CONSIDERED FOR DELETION--- TBD
		RULES 31-13 THROUGH 31-15 ARE RESERVED.

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	31-16	MESA WILL NOT DEPLOY		A. EXERCISE CONTINGENCY PROCEDURE B. PROCEED TO ALSEP DEPLOYMENT.	NOTE--- EMU RECHARGE NOT POSSIBLE, LIOH AND BATTERIES IN MESA MET NOT AVAILABLE
	31-17	RESERVED			
	31-18	RESERVED			
	31-19	RESERVED			
	31-20	RESERVED			
	31-21	SAMPLE RETURN CONTAINER LATCH WILL NOT LATCH A. ONE LATCH WILL NOT LATCH B. BOTH LATCHES WILL NOT LATCH		A. CONTINUE MISSION. B. DISCARD SRC AND TRANSFER SAMPLES IN EQUIPMENT TRANSFER BAG.	
	31-22	RESERVED			
	31-23	SPECIAL ENVIRONMENTAL SAMPLE CONTAINER WILL NOT CLOSE		PLACE THE SAMPLE IN SAMPLE BAG AND DISCARD CONTAINER	

MISSION RULES

SECTION 31 - LUNAR SURFACE OPERATIONS

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	31-24	RESERVED			
	31-25	RESERVED			
	31-26	ALS CLOSE-UP CAMERA CYCLE LIGHT DOES NOT FUNCTION		A. IF FLASH OCCURS CONTINUE MISSION B. IF NO FLASH REMOVE CASSETTE AND DISCARD CAMERA.	HOLD CAMERA ABOVE SURFACE, DEPRESS TRIGGER AND CHECK FOR FLASH.
	31-27	ALS CLOSE-UP CAMERA CYCLE LIGHT REMAINS ON FOR MORE THAN 10 SECONDS		IF LIGHT GOES OUT WITHIN 25 SECONDS CONTINUE MISSION IF LIGHT STAYS ON REMOVE CASSETTE AND DISCARD CAMERA	
	31-28	SCIENTIFIC EQUIPMENT BAY DOORS WILL NOT OPEN		ABANDON ALSEP	PLAN EXTENDED TRAVERSE ALSEP PACKAGE 1+2, LUNAR PORTABLE MAGNETOMETER+ALHT ARE LOCATED IN SEQ BAY
	31-29	RESERVED			
	31-30	RESERVED			
	31-31	SEQ BAY DOORS WILL NOT CLOSE		CONTINUE MISSION	
	31-32	POSITIVE LOSS OF ANY METER ON LUNAR PORTABLE MAGNETOMETER		DISCARD THE INSTRUMENT	METER NEEDLE BECOMES PHYSICALLY BROKEN, STUCK OR OTHERWISE UNABLE TO PROVIDE A READING.
		RULES 31-33 THROUGH 31-39 ARE RESERVED			

R	ITEM	
	31-40	GENERAL ALSEP GENERAL OPERATIONAL GUIDELINES ARE BASED ON OBJECTIVES IN THE FOLLOWING PRIORITIES--- A. PSE B. ASE C. SIDE D. CPLEE E. DTREM F. ENGINEERING ALSEP DEPLOYMENT SEQUENCE IS---
	31-41	THE ALSEP TURN-ON SEQUENCE IS--- A. ASTRONAUT ACTIVATES SHORTING PLUG SWITCH ASAP AFTER DEPLOYMENT. B. CREW WILL ACTIVATE ASTRO SWITCH NO. 1 + 5 PER DIRECTION FROM THE GROUND. SWITCH NO. 1 WILL BE ACTIVATED BASED ON PREDICTED AVAILABILITY OF 38.2 WATTS FROM THE RTG (SEE FIGURE 3.2-2, ALSEP SODB).
	31-42	IF THE GROUND IS UNABLE TO COMMAND A TRANSMITTER ON AND/OR EXPERIMENTS ON, THE ASTRONAUT WILL TURN ON ASTRO SWITCHES NO.2 AND/OR NO.3 AND/OR NO.4 DURING EVA NO.1 WHEN REQUESTED FROM THE GROUND. THE X MITER WILL NOMINALLY BE INITIATED BY THE TRIPPING OF THE HOLD OFF CURRENT. THE ASE THUMPER ACTIVITY WILL BE PERFORMED REGARDLESS OF GROUND CMD CAPABILITY.
	31-43	IF ALSEP DEPLOYMENT TIME BECOMES CONSTRAINED AND THE CREW MUST RETURN TO THE LM, THE RTG SHORTING SWITCH AND ASTRONAUT SWITCH NO. 1 SHALL BE ACTUATED BY THE CREW IF THE ANTENNA IS LEVELED AND ALIGNED. IF THE ANTENNA IS NOT LEVEL AND ALIGNED, THESE SWITCHES SHALL NOT BE ACTUATED. (PICK UP HERE ON EVA NO. 2).
	31-44	RESERVED
	31-45	A R/S CARRIER WILL BE MAINTAINED IN THE SAFED CONFIGURATION DURING THE TIME THE CREW IS ON THE LUNAR SURFACE EXCEPT TO SEND CMDS AND FOR SITE HAND OVER
	31-46	THE ASE WILL BE COMMANDED TO STAND BY IF THE THUMPER ARM OR GRENADE ARM COMES ON WITHOUT COMMAND OR CREW ACTION.
	31-47	THE PSE WILL NOT BE TURNED ON OR UNCAGED UNTIL THE CREW LEAVES THE DEPLOYMENT AREA.

R	ITEM	
	31-48	CPLEE
		A. THE CPLEE WILL BE GROUND COMMANDED TO OPERATE ASAP AFTER DEPLOYMENT
		B. IF THE DUST COVER COMES OFF DURING DEPLOYMENT, DO NOT REINSTALL AND CONTINUE DEPLOYMENT
	31-49	CCGE
		A. THE CCGE WILL BE COMMANDED TO OPERATE-SELECT TO VERIFY THAT IT IS OPERABLE AS SOON AFTER DEPLOYMENT AS POSSIBLE.
		B. THE CCGE WILL NOT BE LEFT IN OPERATE-SELECT FOR LONGER THAN 5 MINUTES WITH THE DUST COVER INSTALLED.
		C. GROUND COMMAND 105/107 (REMOVE DUST COVER) WILL NOT BE SENT PRIOR TO OPERATING THE CCGE IN BOTH THE CAL ENABLE MODE AND THE RANGE MODE A (NORMAL MODE). THE DUST COVER WILL NOMINALLY BE REMOVED BETWEEN 2ND EVA TERMINATION AND LM ASCENT.
	31-50	ASE
		A. FOR OPERATION OF THE ASE IN THE THUMPER OR MORTAR MODES, SUFFICIENT TIME WILL BE ALLOWED AFTER ASE ACTIVATION TO PERMIT GEOPHONE AMP, TEMPERATURES TO STABALIZE (UP TO 12 MIN.)
		B. A MINIMUM WAITING PERIOD OF 60 SEC. WILL BE ALLOWED BETWEEN ARMING + FIRING THE MORTARS (FOR CHARGING OF CAPACITORS)
		C. IF THE CREW DOES NOT HAVE TIME TO PERFORM THE THUMPER ACTIVITY AND ARM THE GLA ARMING, THE GLA SHALL BE PRIMARY
		D. THE CMD CARRIER WILL REMAIN UP WHILE THE ASE IS IN OPERATE SELECT
	31-51	SIDE/CCIG
		A. THE SIDE/CCIG WILL BE TURNED ON ASAP AFTER DEPLOYMENT
		B. THE CCIG DUST COVER WILL BE REMOVED BY GND. CMD. ASAP AFTER DEPLOYMENT.
		RULES 31-52 THRU 31-70 ARE RESERVED

R	ITEM	

GENERAL

THE FOLLOWING MISSION RULES APPLY TO FLIGHT CREW INVOLVEMENT WITH THE APOLLO LUNAR SURFACE EXPERIMENT PACKAGE (ALSEP) WHILE THE CREW IS ON THE LUNAR SURFACE. THESE RULES ARE EXCERPED FROM THE SYSTEMS MISSION RULES DOCUMENT FOR ALSEP 4. (SMRD FOR ALSEP NO.4) AND MISSING LETTERS ON NUMBERS PERTAINING TO GUIDELINES OR RULING WILL BE FOUND IN THAT DOCUMENT.

ALSEP OPERATIONAL GUIDELINE

31-71 GENERAL

A. THESE ALSEP GENERAL OPERATIONAL GUIDELINES ARE BASED ON OBJECTIVES IN THE FOLLOWING PRIORITIES---

(1) PSE
(2) ASE
(3) SIDE
(4) CPLEE
(5) DTREM (M515)
(6) ENGINEERING

NOTE - RIPPLE-OFF SEQUENCE--- 1) CPLEE, 2) SIDE, AND 3) PSE.

B THROUGH K - REFERENCE SMRD FOR ALSEP NO.4

L. THE ALSEP TURN-ON SEQUENCE IS---

(1) ASTRONAUT ACTIVATES SHORTING PLUG SWITCH ASAP AFTER DEPLOYMENT.

(2) CREW WILL ACTIVATE ASTRO SWITCHES NO. 1 AND NO. 5 PER DIRECTION FROM THE GROUND. SWITCHES NO. 1 AND NO. 5 WILL BE ACTIVATED BASED ON PREDICTED AVAILABILITY OF 33.2 WATTS FROM THE RTG (SEE FIGURE 3.2-2, ALSEP SODB).

R	ITEM	
		M. IF THE GROUND IS UNABLE TO COMMAND A TRANSMITTER ON AND/OR EXPERIMENTS ON, THE ASTRONAUT WILL TURN ON ASTRO SWITCHES NO. 2 AND/OR NO.3 AND/OR NO.4 DURING EVA NO.1 WHEN REQUESTED FROM THE GROUND. THE TRANSMITTER WILL NOMINALLY BE INITIATED BY THE TRIPPING OF THE HOLD OFF CIRCUIT. THE ASE THUMPER ACTIVITY WILL BE PERFORMED REGARDLESS OF GROUND COMMAND CAPABILITY.
		N THROUGH O - REFERENCE SMRD FOR ALSEP NO.4
		P. IF ALSEP DEPLOYMENT TIME BECOMES CONSTRAINED AND THE CREW MUST RETURN TO THE LM, THE RTG SHORTING SWITCH AND ASTRONAUT SWITCH NO.1 SHALL BE ACTUATED BY THE CREW IF THE ANTENNA IS LEVELED AND ALIGNED. IF THE ANTENNA IS NOT LEVEL AND ALIGNED, THESE SWITCHES SHALL NOT BE ACTUATED. (PICK UP HERE ON EVA NO.2).
		Q THROUGH R - REFERENCE SMRD FOR ALSEP NO.4
		S. THE COMMAND CARRIER WILL BE MAINTAINED ON AND IN THE SAFED CONFIGURATION EXCEPT TO SEND COMMANDS AND REMOTE SITE HANDOVERS FROM DEPLOYMENT INITIATION UNTIL AFTER LM LIFT-OFF TO PROVIDE ADDITIONAL PROTECTION AGAINST THE GENERATION OF SPURIOUS COMMANDS.
		T - REFERENCE SMRD FOR ALSEP NO.4
		U. THE ASE WILL BE COMMANDED TO STANDBY SELECT IF THE THUMPER ARM OR GERNADE ARM WARNING OCCURS WITHOUT GROUND COMMAND OR CREW ACTION.
	31-72	REFERENCE SMRD FOR ALSEP NO. 4
	31-73	ASE OPERATIONAL GUIDELINES
		A. OPERATION OF THE ASE, IN ANY MODE, WILL BE PERFORMED ONLY WHEN ASI-1 (CENTRAL STATION PACKAGE TEMP.) IS ABOVE -20 DEG C, AS-2 (MOTOR BOX TEMP.) IS ABOVE -30 DEG C, AND AS-3 (GRENADE LAUNCHER ASSEMBLY TEMP) IS ABOVE -30 DEG. C.
		B THROUGH D REFERENCE SMRD FOR ALSEP NO. 4
		E. FOR OPERATION OF THE ASE IN THE THUMPER OR MORTAR MODES, SUFFICIENT TIME WILL BE ALLOWED AFTER ASE ACTIVATION TO PERMIT GEOPHONE AMPLIFIER TEMPERATURES TO STABILIZE. (UP TO 15 MINUTES.)
		F THROUGH K - REFERENCE SMRD FOR ALSEP NO. 4.
		L. IF THE CREW DOES NOT HAVE TIME TO DO THE THUMPER ACTIVITY AND ARM THE GLA, ARMING THE GLA SHALL BE PRIMARY.
	31-74	THROUGH 31-132 - REFERENCE SMRD FOR ALSEP NO. 4

MISSION RULES

SECTION 31 - LUNAR SURFACE OPERATIONS

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	31-133	DURING DEPLOYMENT GROUND IS UNABLE TO COMMAND TO HIGH BIT RATE.		A. SEE RULE 31-101 B. (1) HAVE THE CREW ACTIVATE SWITCH NO. 4, FOR THUMPER ACTIVITY.	(ALSEP 4 SYSTEMS MISSION RULES)
				(2) AT COMPLETION OF THUMPER ACTIVITY, ATTEMPT TO COMMAND TO HBR OFF (CMD 005) PRIOR TO TURNING SWITCH NO. 5 CW.	SWITCH NO 5 WILL BE TURNED CCW JUST PRIOR TO CREW DEPARTING AREA.
	31-134	REFERENCE SMRD FOR ALSEP NO. 4			
	31-135	DURING DEPLOYMENT, GROUND UNABLE TO COMMAND ASE TO OPERATE.		A. SEE RULE 31-101 B. PRIOR TO THUMPER MODE--- (1) HAVE CREW ACTIVATE SWITCH NO. 4 (2) CMD TO NBR (CMD 005-HBR-OFF) (3) CM TO HBR (CMD 003-HBR SEL) WHEN GEOPHONE NO. 2 IS IMPLACED (4) CMD TO NBR (CMD 005-HBR OFF) AT COMPLETION OF THUMBER MODE	(ALSEP 4 SYSTEMS MISSION RULES) THIS MALFUNCTION CAN RESULT FROM A TOTAL CMD SYSTEM FAILURE OR A SINGLE CMD GATE FAILURE THE RULING APPLIES IN EITHER CASE
				(5) TURN SWITCH NO 5 CW AS IN NORMAL DEPLOYMENT SEQUENCE	STEP 5 PUTS ASE IN STAND-BY SELECT ALSEP IN NBR
				(6) AFTER GLA ARMING AND SAFING PIN REMOVAL, ACTIVATE SWITCH NO. 4 AFTER TURNING SWITCH NO. 5 CCW (7) CMD TO NBR (CMD 005-HBR OFF)	STEP 6 AND 7 LEAVE ASE IN OPERATE SELECT ALSEP IN NBR. ASE WILL NOT SURVIVE LUNAR NIGHT IN OPERATE SELECT

R	RULE	CONDITION/MALFUNCTION	PHASE	RULING	CUES/NOTES/COMMENTS
	31-136	REFERENCE SMRD FOR ALSEP NO. 4			
	31-137	ASI FAILS TO DETONATE.		A. ATTEMPT TO FIRE AGAIN. B. GO TO NEXT ASI, BUT CONTINUE TO ATTEMPT TO FIRE IN THE SAME LOCATION UNTIL AN AST DOES FIRE	EVEN SPACING OF ASI FIRING IS MORE IMPORTANT THAN TOTAL DISTRIBUTION OF FIRINGS
		31-138 THROUGH 31-143 REFERENCE SMRD FOR ALSEP NO. 4			
	31-144	SIDE DUST COVER COMES OFF DURING DEPLOYMENT		DO NO REINSTALL	CONTINUE DEPLOYMENT.
		31-145 THROUGH 31-150 REFERENCE SMRD FOR ALSEP NO.4			
	31-151	CPLEE DUST COVER COMES OFF DURING DEPLOYMENT.		DO NO REINSTALL	CONTINUE DEPLOYMENT.

APPENDICES

A ACRONYMS AND SYMBOLS

R	ITEM		
	AC	ALTERNATING CURRENT	
	ACA	ATTITUDE CONTROLLER ASSEMBLY	
	ACCEL	ACCELEROMETER	
	ACCUM	ACCUMULATOR	
	ACS	ATTITUDE CONTROL AND STABILIZATION SYSTEM	
	ACT	ACTUATOR	
	ADEG	AUXILIARY DISPLAY EQUIPMENT GROP	
	AEA	ABORT ELECTRONICS ASSEMBLY	
	AELD	ASCENT ENGINE LATCHING DEVICE	
	AFD	ASSISTENT FLIGHT DIRECTOR	
	AFETR	AIR FORCE EASTERN TEST RANGE	
	A/G	AIR-TO-GROUND	
	AGS	ABORT GUIDANCE SYSTEM	
	ALDS	APOLLO LAUNCH DATA SYSTEM	
	ALT	ALTERNATE	
	AM	AMPLITUDE MODULATION	
	AMP	AMPERE(S)	
	ANT	ANTENNA	
	AOA	ANGLE OF ATTACK	
	AOH	APOLLO OPERATIONS HANDBOOK	
	AOT	ALIGNMENT OPTICAL TELESCOPE	
	APS	ASCENT PROPULSION SYSTEM	
	APS	AUXILIARY PROPULSION SYSTEM	
	ARIA	APOLLO RANGE INSTRUMENTATION AIRCRAFT	
	ASA	ABORT SENSOR ASSEMBLY	
	ASAP	AS SOON AS PRACTICAL	
	ASC	ASCENT	
	ATCA	ATTITUDE TRANSLATION CONTROLLER ASSEMBLY	
	ATP	ALTERNATE TARGET POINT	
	ATT	ATTITUDE	
	AUX	AUXILIARY	
	AZUSA	ELECTRONIC TRACKING AND VECTORING SYSTEM ETR	
	BA	BANK ANGLE	
	BAP	BEST ADOPTIVE PATH	
	BAT	BATTERY	
	BDA	BERMUDA MSFN REMOTED SITE	
	B/H	BLOCK HOUSE	
	BMAG	BODY MOUNTED ATTITUDE GYRO	
	BRSO	BERMUDA RANGE SAFETY OFFICER	
	BSE	BOOSTER SYSTEMS ENGINEER	
	BTU	BRITISH THERMAL UNIT	
	CAL	CALIBRATE	
	CASTS	COUNTDOWN AND STATUS TRANSMISSION SYSTEM	
	CB	CIRCUIT-BREAKER	
	CCATS	COMMAND, COMMUNICATIONS, AND TELEMETRY SYSTEM	
	CCW	COUNTERCLOCKWISE	
	CDH	CONSTANT DELTA HEIGHT	
	CDP	COMMAND DATA PROCESSOR	
	CDR	COMMANDER	
	CDU	COUPLING DATA UNIT	
	CES	CONTROL ELECTRONICS SYSTEM	
	CEVT	CONTINGENCY EXTRA VEHICULAR TRANSFER	
	CFM	CUBIC FEET PER MINUTE	
	CIF	CENTRAL INSTRUMENTATION FACILITY	
	CIM	COMPUTER INPUT MATRIX	
	CKT	CIRCUIT	
	CLTC	CHIEF LAUNCH VEHICLE TEST CONDUCTOR	
	CM	COMMAND MODULE	
	CMC	COMMAND MODULE COMPUTER	
	CMD	COMMAND	
	CMP	COMMAND MODULE PILOT	
	C/O	CUTOFF	
	CO2	CARBON DIOXIDE	
	COAS	CREW OPTICAL ALIGNMENT SIGHT	
	COI	CONTINGENCY ORBIT INSERTION	
	COMM	COMMUNICATION	
	CONF	CONFERENCE	
	CONTROL	LM GNC SYSTEMS ENGINEER	
	CP	COMMUNICATIONS PROCESSOR	
	CRO	CARNARVON MSFN REMOTED SITE	
	CRYO	CRYOGENICS	
	CSI	CONCENTRIC SEQUENCE INITIATE	
	CSM	COMMAND SERVICE MODULE	
	CTE	CENTRAL TIMING EQUIPMENT	
	CVS	CONTINUOUS VENT SYSTEM	
	CVTS	CHIEF VEHICLE TEST SUPVISOR	
	CW	CLOCKWISE	
	C&W	CAUTION AND WARNING	
	CYI	CANARY ISLAND	
	DAP	DIGITAL AUTO PILOT	
	DB	DEADBAND	
	DC	DIRECT CURRENT	
	DCA	DIGITAL COMMAND ASSEMBLY	
	DCS	DIGITAL COMMAND SYSTEM	
	DDD	DIGITAL DISPLAY DRIVER	
	DECA	DESCENT ENGINE CONTROL ASSEMBLY	
	DEDA	DATA ENTRY AND DISPLAY ASSEMBLY	
	DEG	DEGREE	
	DESC	DESCENT	
	DFI	DEVELOPMENT FLIGHT INSTRUMENTATION	
	DK	DOCK	
	DKD	DOCKED	
	DOD	DEPARTMENT OF DEFENSE	
	DPS	DESCENT PROPULSION SYSTEM	
	DRA	DISCRETE RECOVERY AREA	
	DRS	DATA RECEIVING STATION	
	DSC	DYNAMIC STANDBY COMPUTER	
	DSE	DATA STORAGE EQUIPMENT	
	DSKY	DISPLAY KEYBOARD	
	DTO	DETAILED TEST OBJECTIVE	
	D/TV	DIGITAL TO TELEVISION	
	ECS	ENVIRONMENTAL CONTROL SYSTEM	
	EDS	EMERGENCY DETECTION SYSTEM	
	EECOM	ELECTRICAL, ENVIRONMENTAL, AND COMMUNICATIONS	
	EKG	ELECTROCARDIOGRAM	
	EMR	ERROR MONITOR REGISTER	
	EMS	ENTRY MONITORING SYSTEM	
	EMU	EXTRA-VEHICULAR MOBILITY UNIT	
	ENG	ENGINE	
	EPS	ELECTRICAL POWER SYSTEM	
	ERR	ERROR	
	ESE	ELECTRONIC SUPPORT EQUIPMENT	
	ETDM	RANGE SAFETY SUPERVISOR KSC CALLOUT	
	ETR	EASTERN TEST RANGE	
	EVA	EXTRA-VEHICULAR ACTIVITY	
	EVAP	EVAPORATOR	
	EVT	EXTRA-VEHICULAR TRANSFER	
	EVVA	EXTRA-VEHICULAR VISOR ASSEMBLY	
	F/A	FORWARD/AFT	
	FC	FUEL CELL OR FLIGHT CONTROL	
	FCSM	FLIGHT COMBUSTION STABILITY MONITOR	
	FD	FLIGHT DIRECTOR	
	FDAI	FLIGHT DIRECTOR ATTITUDE INDICATOR	
	FDO	FLIGHT DYNAMICS OFFICER	
	FIDO	FLIGHT DYNAMICS OFFICER	
	FIG	FIGURE	
	FITH	FIRE IN THE HOLE	

R	ITEM		
		FL	FULL LIFT
		FM	FREQUENCY MODULATION
		FPS	FEET PER SECOND
		FQR	FLIGHT QUALIFICATION RECORDER
		FTP	FIXED THROTTLE POINT
		G	GRAVITY
		G&C	GUIDANCE AND CONTROL
		GASTA	GIMBAL ANGLE SEQUENCE TRANSLATION ASSEMBLY
		GBI	GRAND BAHAMA ISLAND
		GDA	GIMBAL DRIVE ASSEMBLY
		GDC	GYRO DISPLAY COUPLER
		GET	GROUND ELAPSED TIME
		GETI	GROUND ELAPSED TIME OF IGNITION
		GMT	GREENWICH MEAN TIME
		GMTLO	GREENWICH MEAN TIME OF LIFTOFF
		G&N	GUIDANCE AND NAVIGATION
		GN2	GASEOUS NITROGEN
		GNC	GUIDANCE NAVIGATION CONTROL
		GNCS	GUIDANCE, NAVIGATION, AND CONTROL SYSTEM
		GND	GROUND
		GRR	GUIDANCE REFERENCE RELEASE
		GSFC	GODDARD SPACE FLIGHT CENTER
		GTS	GIMBAL TRIM SYSTEM
		GUIDO	GUIDANCE OFFICER
		H2	HYDROGEN
		H2O	WATER
		HA	HEIGHT OF APOGEE
		HAW	HAWAII
		HBR	HIGH-BIT-RATE
		HF	HIGH FREQUENCY
		HP	HEIGHT OF PERIGEE
		HS	HIGH-SPEED
		HZ	HERTZ
		IC	INTERCOMMUNICATIONS EQUIPMENT
		IGA	INNER GIMBAL AXIS
		IMU	INERTIAL MEASUREMENT UNIT
		INJ	INJECTOR
		INST	INSTRUMENTATION
		INV	INVERTER
		IP	IMPACT POINT OR IMPACT PREDICTION
		IRIG	INERTIAL RATE INTEGRATING GYRO
		ISOL	ISOLATION
		ISS	INERTIAL SUBSYSTEM
		IU	INSTRUMENTATION UNIT
		IVT	INTRAVEHICULAR TRANSFER
		JD	JET DRIVER
		KOH	POTASSIUM HYDROXIDE
		KSC	KENNEDY SPACE CENTER
		LB	POUND
		LBR	LOW-BIT-RATE
		LCG	LIQUID COOLING GARMENT
		LES	LAUNCH ESCAPE SYSTEM
		LET	LAUNCH ESCAPE TOWER
		LGC	LM GUIDANCE COMPUTER
		LH2	LIQUID HYDROGEN
		LIOH	LITHIUM HYDROXIDE
		LM	LUNAR MODULE
		LMDE	LM DESCENT ENGINE
		LMP	LM MODULE PILOT
		L/O	LIFTOFF
		LOI	LUNAR ORBIT INSERTION
		LOS	LINE-OF-SIGHT
		LOX	LIQUID OXYGEN
		L/R	LEFT/RIGHT
		LV	LOW-VOLTAGE
		L/V	LAUNCH VEHICLE
		LVDA	LAUNCH VEHICLE DATA ADAPTER
		LVDC	LAUNCH VEHICLE DIGITAL COMPUTER
		MALF	MALFUNCTION
		MCC	MISSION CONTROL CENTER
		MCC	MIDCOURSE CORRECTION
		MC&W	MASTER CAUTION AND WARNING
		MDAS	MEDICAL DATA ACQUISITION SYSTEM
		MED	MANUAL ENTRY DEVICE
		MESC	MASTER EVENTS SEQUENCE CONTROLLER
		MFCO	MANUAL FUEL CUTOFF
		MFV	MAIN FUEL VALVE
		MGA	MIDDLE GIMBAL AXIS
		MIL	MERRITT ISLAND
		MITE	MASTER INSTRUMENTATION TIMING EQUIPMENT
		MNFLD	MANIFOLD
		M&O	MAINTENANCE AND OPERATION
		MOC	MISSION OPERATIONS COMPUTER
		MSFN	MANNED SPACE FLIGHT NETWORK
		MSK	MANUAL SELECT KEYBOARD
		MSTC	CSM SPACECRAFT TEST CONDUCTOR
		MTVC	MANUAL THRUST VECTOR CONTROL
		MUX	MULTIPLEXER
		NASA	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
		NCC	COMBINED CORRECTIVE MANEUVER
		NM	NAUTICAL MILES
		NPV	NON-PROPULSIVE VENT
		NSR	COELLIPTICAL MANEUVER
		O2	OXYGEN
		O/B	ONBOARD
		ODOP	OFFSET DOPPLER AND POSITION
		OGA	OUTER GIMBAL AXIS
		OMSF	OFFICE OF MANNED SPACE FLIGHT
		OPS	OXYGEN PURGE SYSTEM
		ORDEAL	ORBITAL RATE DRIVE ELECTRONICS APOLLO LM
		OXID	OXIDIZER
		PAFB	PATRICK AIR FORCE BASE
		PAM	PULSE AMPLITUDE MODULATION
		PB	PUSH-BUTTON
		PC	PERICYNTHION
		PCM	PULSE CODE MODULATION
		PCMGS	PULSE CODE MODULATION GROUND STATION
		PCO2	PARTIAL PRESSURE CARBON DIOXIDE
		PDS/DD	PLOTTING DISPLAY SUBCHANNEL/DATA DISTRIBUTION
		PGA	PRESSURE GARMENT ASSEMBLY
		PGNCS	PRIMARY GUIDANCE AND NAVIGATION CONTROL SYSTEM CSM
		PGNS	PRIMARY GUIDANCE AND NAVIGATION SYSTEM LM

R	ITEM		
		PIPA	PULSE INTEGRATING PENDULOUS ACCELEROMETER
		PLSS	PORTABLE LIFE SUPPORT SYSTEM
		PO	POWER OUT
		PO2	PARTIAL PRESSURE OXYGEN
		POS	POSITION
		POS	PRIMARY OXYGEN SYSTEM
		PPM	PARTS PER MILLION
		PQGS	PROPELLANT QUANTITY GAGING SYSTEM
		PRELN	PRELAUNCH
		PRESS	PRESSURE
		PRI	PRIMARY
		PROC	PROCEDURE
		PROP	PROPELLANT
		PSA	POWER SERVO AMPLIFIER
		PSI	POUNDS PER SQUARE INCH
		PSID	POUNDS PER SQUARE INCH DIFFERENCE
		PSS	PAD SAFETY SUPERVISOR
		PTA	PULSE TORQUE ASSEMBLY
		PTP	PREFERRED TARGET POINT
		PTV	PITCH THRUST VECTOR
		PU	PROPELLANT UTILIZATION
		PUGS	PROPELLANT UTILIZATION AND GAGING SYSTEM
		PVT	PRESSURE-VOLUME-TEMPERATURE
		PYRO	PYROTECHNICS
		QTY	QUANTITY
		RAD	RADIATOR
		RET	RETRACT
		RCS	REACTION CONTROL SYSTEM
		RCU	REMOTE CONTROL UNIT
		RCVR	RECEIVER
		REF	REFERENCE
		REFSMMAT	REFERENCE STABLE MEMBER MATRIX
		REQD	REQUIRED
		RETRB	RETRO ELAPSED TIME TO REVERSE B
		RETRO	RETROFIRE OFFICER
		REV	REVOLUTION
		RF	RADIO FREQUENCY
		RFO	RETROFIRE OFFICER
		RGA	RATE GYRO ASSEMBLY
		RHC	ROTATION HAND CONTROLLER
		RIP	RANGE OF IMPACT POINT
		RL	ROLL LEFT
		RNDZ	RENDEZVOUS
		RP-RT	DOWNRANGE ERROR
		RR	RENDEZVOUS RADAR
		RR	ROLL RIGHT
		RSI	ROLL STABILITY INDICATOR
		RSO	RANGE SAFETY OFFICER
		RSVR	RESOLVER
		RTACF	REAL-TIME AUXILIARY COMPUTING FACILITY
		RTC	REAL-TIME COMMAND
		RTCC	REAL-TIME COMPUTER COMPLEX
		S/C	SPACECRAFT
		SCE	SIGNAL CONDITIONING EQUIPMENT
		SCS	STABILIZATION AND CONTROL SYSTEM
		SEC	SECONDARY
		SEC	SECOND
		SECO	SUSTAINER ENGINE CUTOFF S-IVBCUTOFF
		SECS	SEQUENTAL EVENTS CONTROL SYSTEM
		SHE	SUPER-CRITICAL HELIUM
		SIG	SIGNAL
		SLA	SPACECRAFT LM ADAPTER
		SLV	SATURN LAUNCH VEHICLE
		SM	SERVICE MODULE
		SMJC	SERVICE MODULE JETTISON CONTROLER
		SODB	SPACECRAFT OPERATIONAL DATA BOOK
		SOL	SOLENOID
		SOP	STANDARD OPERATING PROCEDURE
		SOV	SHUT-OFF VALVE
		SPAN	SPACECRAFT PLANNING AND ANALYSIS
		SPS	SERVICE PROPULSION SYSTEM
		SRO	SUPERINTENDENT RANGE OPERATIONS
		SSC	SPACE SUIT COMMUNICATOR
		STBY	STANDBY
		SW	SWITCH
		SXT	SEXTANT
		TB	TIME BASE
		TBD	TO BE DETERMINED
		TC	TEST CONDUCTOR
		T/C	TELEMETRY AND COMMUNICATIONS
		TCE	CONDENSER EXHAUST TEMPERATURE
		TCP	THRUST CHAMBER PRESSURE
		TD&E	TRANSPORTATION, DOCKING AND EJECTION
		TDP	TELEMETRY DATA PROCESSOR
		TELCOM	LM EECOM
		TEMP	TEMPERATURE
		TFF	TIME OF FREE FALL
		THC	THRUST AND CONTROLLER
		TIG	TIME OF IGNITION
		TLI	TRANSLUNAR INJECTION
		TM	TELEMETRY
		TMG	THERMAL METEROID GARMENT
		TNK	TANK
		TOK	THRUST OKAY
		TPF	TERMINAL PHASE FINALIZATION
		TPI	TERMINAL PHASE INITIATE
		TRNS	TRANSFER
		TRUN	TRUNNION
		TTC	TRANSLATION THRUST CONTROLLER
		TTY	TELETYPE
		TVC	THRUST VECTOR CONTROL
		U/D	UP/DOWN
		UDL	UPDATA LINK
		UHF	ULTRA HIGH FREQUENCY
		UNDKD	UNDOCKED
		USB	UNIFIED S-BAND
		VC	VELOCITY COUNTER
		VEI	INERTIAL VELOCITY AT ENTRY
		VGX	VELOCITY TO BE GAINED X-AXIS
		VGY	VELOCITY TO BE GAINED Y-AXIS
		VGY	VELOCITY TO BE GAINED Z-AXIS
		VHF	VERY HIGH FREQUENCY
		VLV	VALVE
		VSM	VIDEO SWITCHING MATRIX
		WBD	WIDE-BAND DATA
		WMS	WASTE MANAGEMENT SYSTEM
		WT	WEIGHT
		XFEED	CROSSFEED
		XMIT	TRANSMIT
		XMTR	TRANSMITTER
		Y	YAW OR Y-AXIS
		YTV	YAW THRUST VECTOR
		Z	Z-AXIS

R	ITEM	

SYMBOLS

H	ALTITUDE
DELTA VIN	DELTA VELOCITY IN INSERTION
DELTA TB	DELTA BURN TIME
DELTA H	DELTA ALTITUDE

B DISTRIBUTION LIST

R	ITEM

DISTRIBUTION LIST

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R	ITEM

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C CHANGE CONTROL

R	ITEM

CHANGE CONTROL

1.0 INTRODUCTION

1.1 PURPOSE

THE PURPOSE OF THIS APPENDIX IS TO DELINEATE CHANGE CONTROL PROCEDURES FOR THE MISSION RULES. THIS WILL INSURE THE PROPER COORDINATION OF CHANGES, PROVIDE A RECORD OF PROPOSED CHANGES (INCLUDING THE RATIONALE FOR MAKING THEM), AND WILL PROVIDE A MEANS FOR PROMULGATING INDIVIDUAL RULE UPDATES BETWEEN REVISIONS (INTERIM CHANGES).

1.2 EFFECTIVITY

NOVEMBER 1, 1970

2.0 CHANGE PROCEDURES

2.1 SUBMISSION OF CHANGES

PROPOSED CHANGES ARE SOLICITED FROM ANY INDIVIDUAL OR ORGANIZATION HAVING A VALID INPUT. CHANGES ORIGINATING OUTSIDE THE FLIGHT CONTROL TEAM WILL BE SUBMITTED DIRECTLY TO THE ASSISTANT FLIGHT DIRECTOR (AFD). CHANGES ORIGINATING WITHIN THE FLIGHT CONTROL TEAM WILL BE SUBMITTED TO THE AFD VIA PRIME MISSION OPERATIONS CONTROL ROOM (MOCR) POSITION CONCERNED.

2.1.1 FORMAT

PERSONS DESIRING TO SUBMIT A PROPOSED CHANGE WILL COMPLETE ALL ITEMS ON THE FORM SHOWN IN FIGURE C-1 (FORM MUST BE TYPED). ADDITIONAL PAGES MAY BE USED IF THE SPACE PROVIDED IS NOT ADEQUATE. THE COMPLETED ORIGINAL FORM AND ONE COPY WILL THEN BE FORWARDED TO THE AFD.

THE AFD WILL REVIEW THE FORM FOR COMPLETENESS AND PROPER MISSION RULE FORMAT, AND MAKE CORRECTIONS AS REQUIRED. THE ORIGINATOR WILL BE ADVISED OF ANY SUCH CHANGES.

2.2 APPROVAL

2.2.1 COORDINATION

THE ORIGINATOR OF THE CHANGE MAY OBTAIN PRELIMINARY CONCURRENCES. THE AFD WILL, HOWEVER, OBTAIN FORMAL CONCURRENCES OR DISAPPROVALS (VERBALLY OR BY INITIATING) FROM THE NECESSARY PERSONNEL. VERBAL CONCURRENCES WILL BE INDICATED IN THE APPROPRIATE SIGNATURE BOX.

2.2.2 SIGNOFF/DISAPPROVAL

UPON OBTAINING THE REQUIRED CONCURRENCES OR NEGATIVE COMMENTS, THE AFD WILL PRESENT THE PROPOSED CHANGE TO THE FLIGHT DIRECTOR FOR FINAL APPROVAL OR DISAPPROVAL. THE AFD MAY SIGN OFF OR DISAPPROVE PROPOSED CHANGES IN THE ABSENCE OF THE FLIGHT DIRECTOR.

2.2.3 DISAPPROVED CHANGES

IF A CHANGE IS DISAPPROVED THE AFD WILL RETURN THE COPY TO THE ORIGINATOR. A COPY OF THE REQUESTED CHANGE WILL BE RETAINED FOR FUTURE REFERENCE.

2.3 PUBLICATION AND DISTRIBUTION OF INTERIM CHANGES

INTERIM CHANGES WILL BE DISTRIBUTED VIA AN ABBREVIATED DISTRIBUTION LIST CONSISTING OF THE MISSION CONTROL TEAM, PERTINENT NASA ORGANIZATIONS, AND THE APPROPRIATE VEHICLE CONTRACTOR(S).

3.0 REVISIONS

3.1 DEVELOPMENT

THE AFD WILL COMPILE THE EFFECTIVE INTERIM CHANGES AND CORRECTIONS OF MINOR TYPOGRAPHICAL ERRORS INTO COMPLETE PAGE CHANGES TO THE BASIC DOCUMENT. (''PEN AND INK'' CHANGES MAY BE USED TO CORRECT TYPOGRAPHICAL ERRORS IF THERE ARE NO OTHER CHANGES IN THE PAGE CONCERNED.)

R	ITEM

3.2 APPROVAL

SINCE ALL INTERIM CHANGES WILL HAVE RECEIVED PRIOR CONCURRENCES AND APPROVAL, ONLY THE FLIGHT DIRECTOR (OR THE AFD IN THE FLIGHT DIRECTOR'S ABSENCE) WILL BE REQUIRED TO APPROVE REVISIONS.

3.3 PUBLICATION

3.3.1 SCHEDULE

REVISIONS WILL BE MADE ON AN "AS REQUIRED" BASIS.

3.3.2 DISTRIBUTION

REVISIONS WILL BE PRINTED AND DISTRIBUTED THROUGH THE NORMAL ADMINISTRATIVE CHANNELS.

NASA-MANNED SPACECRAFT CENTER
MISSION RULE REQUEST/REVISION

_____ DATE _____

REV	RULE	CONDITION/MALFUNCTION	PHASE	RULING	NOTES/COMMENTS

CHANGE RATIONALE: ☐ NEW TECHNICAL DATA ☐ CLARIFICATION

ORIGINATOR: _____ NAME _____ ORGANIZATION _____ EXT

APPROVED: _____ COGNIZANT BRANCH CHIEF

APPROVED: _____ FLIGHT DIRECTOR

AFD: _____ CAPCOM: _____	BSE: _____ O&P: _____	FIDO: _____	AEROMED: _____	GUIDO: _____ RETRO: _____	CONTROL: _____ GNC: _____	TELCOM: _____ EECOM: _____	OTHER: _____

MSC FORM 1555 (Rev. Dec 68)

FIG. C-1 - MISSION RULE CHANGE REQUEST FORM

APOLLO

FFMR

FINAL FLIGHT MISSION RULES

APOLLO 14

AS 509/110/LM-8)

NOVEMBER 1, 1970

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